PRELIMINARY INDEX OF REGIONALLY SIGNIFICANT HABITATS FOR CERTAIN MARINE SPECIES OF IMPORTANCE IN PRINCE EDWARD ISLAND AND THE GULF REGION OF NOVA SCOTIA

Therrien, J., R. M^{Bc}Isaac, P. Boyd, S. Bastien-Daigle and C. Godin.

Genivar Consulting Group
Quebec, (Qc)
G2J 1C8

St. Francis Xavier University
Antigonish, (N.S.)
B2J 2W5

Fisheries and Oceans Canada
Moncton, (N.B.)
E1C 9B6

2001

Canadian Manuscript Report of Fisheries and Aquatic Sciences 2584

**Canadian Manuscript Report of
Fisheries and Aquatic Sciences 2584**

December 2001

Preliminary index of regionally significant habitats for certain marine species of importance in Prince Edward Island and the Gulf region of Nova Scotia

By

Therrien, J.[1], R. MacIsaac[2], P. Boyd[3],
S. Bastien-Daigle[4], and C. Godin[4]

[1]Genivar Consulting Group inc., Québec (Qc)
[2]St. Francis Xavier University, Antigonish (N.S.)
[3]Fisheries and Oceans Canada, Antigonish (N.S.)
[4]Fisheries and Oceans Canada, Gulf Fisheries Centre, Moncton (N.B.)

Printed on
recycled paper

© Minister of Public Works and Government Services Canada 2001
Cat. No. Fs 97- 4/2584E ISSN 0706- 6473

Correct citation for this publication:

Therrien, J., MacIsaac, R., Boyd, P., Bastien-Daigle, S and C. Godin. 2001. Preliminary index of regionally significant habitats for certain marine species of importance in Prince Edward Island and the Gulf region of Nova Scotia. Document prepared by Genivar Consulting Group inc., St. Francis Xavier University, and Fisheries and Oceans Canada. Can. Manuscr. Rep. Fish Aquat. Sci. 2584. vii + 217 p.

Abstract:

Therrien, J., MacIsaac, R., Boyd, P., Bastien-Daigle, S and C. Godin. 2001. Preliminary index of regionally significant habitats for certain marine species of importance in Prince Edward Island and the Gulf region of Nova Scotia. Document prepared by Genivar Consulting Group inc., St. Francis Xavier University, and Fisheries and Oceans Canada. Can. Manuscr. Rep. Fish Aquat. Sci. 2584 vii + 217 p.

This document is a useful planning tool for management and conservation needs, whether from the perspective of the *Oceans Act* or of related objectives such as habitat protection, integrated fisheries management plan preparation or ecosystemic management of resources. With the help of many stakeholders (fishers, fishery officers and scientists), a representative portrait of the information currently available on major marine resources in Prince Edward Island and the Gulf region of Nova Scotia was developed. The information is presented in the form of regionally significant habitats for certain marine species. A total of 35 sites are identified and are presented in the form of fact sheet, 28 habitats for one species (species-habitat grouping) and 7 habitats for multiple species, while another 31 sites are only presented on maps, being considered essential to a lesser degree. The term regionally significant habitat is used to characterise each species-habitat grouping representative of a vital habitat for a particular species. These areas are essential for various crucial stages in the life cycle of the species (spawning ground, rearing area, feeding ground, migration area, etc.), or they constitute a major area of concentration, particularly for mostly sedentary species, such as molluscs, for which the boundaries of the area would remain relatively constant from one year to another. Fish concentration areas are generally not included, with the exception of those associated with one particular life stage (larva or juvenile) or a threatened species (cod).

Résumé

Therrien, J., MacIsaac, R., Boyd, P., S. Bastien-Daigle, et C. Godin. 2001. Répertoire préliminaire des habitats régionalement significatifs pour certaines espèces marines d'importance de l'Île-du-Prince-Édouard et du nord-ouest de la Nouvelle-Écosse. Document réalisé par le Groupe conseil Génivar inc., l'Université St-Francis Xavier et Pêches et Océans Canada. Rapp. man. sci. Halieut. Aquat. 2584. vii + 217 p.

Le présent document est un outil de planification utile pour des besoins de gestion et de conservation, que ce soit dans l'optique de la *Loi sur les Océans* ou pour des objectifs connexes comme, par exemple, ceux de la protection de l'habitat, de la préparation de plans intégrés de gestion des pêches ou de la gestion écosystémique des ressources. Avec le concours de multiples intervenants (pêcheurs, agents des pêches et scientifiques), un portrait représentatif de l'information actuellement disponible sur les ressources marines majeures de l'Île-du-Prince-Édouard et du nord-ouest de la Nouvelle-Écosse est fourni. L'information recueillie est présentée sous forme d'habitats régionalement importants pour

certaines espèces marines. Un total de 35 habitats essentiels ont ainsi été identifiés et sont présentés sous forme de fiche synthèse, 28 habitats pour une seule espèce (ensemble habitat-espèce) et 7 habitats pour plusieurs espèces, alors que 31 autres habitats ne sont présentés que sous forme de cartes, étant considérés essentiel mais à un degré moindre. Le terme habitat régionalement important est utilisé pour caractériser chaque ensemble habitat-espèce représentatif d'un habitat vital pour une espèce faunique particulière. Ils sont essentiels pour une des étapes cruciales du cycle de vie de l'espèce (frayère, aire d'alevinage, zone nourricière, zone de migration, etc.), ou bien il s'agit d'un lieu de concentration majeure, particulièrement pour les espèces peu mobiles, comme les mollusques, pour lesquels la délimitation de la zone serait relativement constante d'une année à l'autre. Ainsi, les zones de concentration de poisson ne sont généralement pas retenues, à l'exception de celles associées à un stade de vie particulier (larve ou juvénile) ou à une espèce en difficulté (morue).

PROJECT TEAM

Fisheries and Oceans Canada, Moncton

Scientific Authority, Project Coordinator	:	Sophie Bastien-Daigle
Digital mapping	:	Carole Godin
		Brad Firth

Fisheries and Oceans Canada, Antigonish

Scientific Authority	:	Paul Boyd
Proofing	:	Jessica Jackson

Fisheries and Oceans Canada, Dartmouth

Review	:	Derek Fenton

Genivar Consulting Group inc.

Project leader (biology)	:	Jean Therrien

St. Francis Xavier University

Project leader (socio-economic)	:	Ray MacIsaac

TABLE OF CONTENTS

1. INTRODUCTION 1

1.1 GENERAL OVERVIEW OF THE SOUTHERN GULF 3

1.1.1 Ecological characteristics 3

1.1.2 Economic characteristics 4

2. METHODOLOGY 7

2.1 SELECTED THEMES 7

2.2 DATA COLLECTION 8

2.2.1 Meetings with researchers and fishery officers 8

2.2.2 Literature review 8

2.2.3 Workshop 8

2.3 SIGNIFICANT HABITATS 9

3. REGIONALLY SIGNIFICANT HABITATS 11

3.1.1 Eelgrass beds around P.E.I. and western N.S. 13

3.1.2 High concentrations of Irish moss on the west coast of P.E.I. and in Gulf N.S. 15

3.1.3 Spartina salt marshes around P.E.I. and western N.S. 20

3.2.1 Capelin spawning ground in St. Lawrence Bay 22

3.2.2 Atlantic cod nursery in the Shediac Valley and north of P.E.I. 26

3.2.3 Atlantic herring fall-spawning ground from Amet Sound to St. Georges Bay 31

3.2.4 Atlantic herring fall-spawning ground in Fisherman's Bank and The Ridge 36

3.2.5 Atlantic herring nursery in Northumberland Strait 41

3.2.6 Atlantic herring spring-spawning ground in St. Lawrence Bay 46

3.2.7 Atlantic herring nursery and overwintering area in Shediac Valley 50

3.2.8 Atlantic herring spring-spawning ground from Port Borden to North Cape 55

3.2.9 Atlantic herring fall-spawning ground at North Cape 60

3.2.10 Atlantic mackerel spawning ground in St. Georges Bay 65

3.2.11 Atlantic mackerel spawning ground on Bradelle and Orphan Banks 71

3.2.12 White hake spawning ground in St. Georges Bay 76

3.2.13 White hake nursery in Southern Gulf 82

3.2.14 Bluefin tuna feeding ground around P.E.I. and western N.S. 87

3.3.1 Large-sized American lobster and berried female concentration between Egmont Bay and Wood Islands 93

3.4.1 American oyster high concentration in Tatamagouche Bay 99

3.4.2 American oyster high concentration in the three rivers near Charlottetown 104

3.4.3 American oyster high concentration in Bedeque Bay 109

3.4.4 American oyster high spat concentration in Malpeque Bay 114

3.4.5 Quahog high concentration in Wallace Harbour and Hillsborough Bay 119

3.4.6 Quahog bed in Percival and Inmore Bays 124

3.4.7 Sea scallop recruitment beds along P.E.I. and western N.S. 128

3.5.1 Grey seal whelping ground in the southeast part of the Gulf *133*
3.5.2 Hooded seal whelping ground northeast of P.E.I. *137*
3.5.3 Harp seal whelping ground around North Cape *140*
3.6.1 Pictou Harbour *144*
3.6.2 Pictou Island *149*
3.6.3 St. Georges Bay *152*
3.6.4 Margaree estuary *157*
3.6.5 Cape Breton trough *161*
3.6.6 Fisherman's Bank *165*
3.6.7 Basin Head *169*

4. CONCLUSION **172**

5. REFERENCES **173**

APPENDIX A - SUPPLEMENTARY SPECIES-HABITAT LIST 184
APPENDIX B - LATIN NAMES OF SPECIES IN TEXT 200
APPENDIX C - NAMES OF PERSONS CONSULTED 204
APPENDIX D - LIST OF WORKSHOP PARTICIPANTS 208
APPENDIX E - MAPS OF STATISTICAL DISTRICTS 212

102-02389/

1. INTRODUCTION

At the dawn of a new millennium, the management of the oceans provides a number of opportunities and challenges for Canadians. The diversity, richness and abundance of marine ecosystems will continue to offer important socio-economic and cultural dividends for present and future generations, if properly managed. Oceans still provide great opportunities for scientific research, but also for fisheries, aquaculture, tourism, transportation and commerce, energy production and mining, as well as for emerging technologies. The Canadian identity is rooted in part in our cultural, educational and social heritage, which is, in many cases, associated with our vast marine environment.

Over the last few years, the entire traditional management approach to marine resources has been re-examined. As early as 1982, the adoption of the United Nations' Convention on the Law of the Sea signalled a shift towards a more global perspective with regards to the oceans. The concept of sustainable management of inorganic and organic marine resources was also adopted at that time. Ten years later, Agenda 21, approved at the Rio Conference, affirmed that the protection and sustainable development of the oceans required a new management approach. Agenda 21 dealt with integrated management, protection of the marine environment, and the sustainable development and use of marine resources. Concepts such as the precautionary approach, ecosystem-based management and integrated management have since been adopted within a legal framework. These concepts are now key components of the ocean management objectives of many countries, including Canada.

The *Oceans Act*, given assent in 1996 by the Canadian government and implemented in January 1997, targets the same ocean conservation objectives contained in international accords ratified by Canada. It entrenches the principles of sustainable development, ecosystem-based management, community-based approaches, integrated management, and the precautionary approach as the new framework for a balanced management of ocean resources. The *Oceans Act* works with other existing tools, such as the *Fisheries Act,* which protects commercial species and contains several habitat protection provisions.

In order to meet all these objectives in a practical manner, especially those relating to ecosystem-based and integrated management, a thorough knowledge of the environment is required. This document has been prepared in order to highlight key information required to assess the major ecological areas of Prince Edward Island (P.E.I.) and the Gulf coast of Nova Scotia (N.S.). It

completes previous attempts made to do similar work, which can be found in several reports including: Parks Canada (Maritimes Testing (1985) Ltd., 1987), Marine Environmental Assessment of the Estuary and Gulf of St. Lawrence (White and Johns, 1997), Biodiversity of the Gulf of St. Lawrence (http://www.qc.ec.gc.ca/faune/biodiv/en/table_contents.html). The objective of the present report is to set out the data needed for ocean and coastal zone integrated management within a broader ecosystem management plan. It is part of a pilot project in ecosystem planning designed to meet the objectives of the *Oceans Act*.

A holistic approach to ocean management, as indicated by an ecosystem-based approach, requires the integration of economic, social and environmental objectives. It is aimed at meeting ecosystem conservation criteria while meeting the many needs of stakeholders. An integrated management approach is one of the tools proposed in the new *Oceans Act*, along with the possibility of creating marine protected areas (MPAs), and the establishment and the application of Marine Environmental Quality (MEQ) criteria and standards. These tools are being implemented progressively in various coastal regions of our country. Efficient implementation of this new approach requires the prior identification of significant habitats or ecosystems for marine species.

The present study provides an overall picture of the P.E.I. and Gulf N.S. coastal and marine environments, from the New Brunswick (N.B.) border to St. Lawrence Bay (N.S.). The approach used in this study was compiled from several sources of information:

- empirical ecological knowledge from people, mainly gathered through consultations with stakeholders and through an inventory of data provided by over 1000 fishers and verified by biologists. This information was compiled in two separate atlas for marine and coastal resources (J. Lee MacNeill & Associates, 1998, 2001);
- stock status, stock assessment and research reports done by DFO scientists;
- information gathered earlier for the northeast coast of N.B. in a report entitle «*Preliminary index of essential habitats for certain marine species of importance in the eastern region of New Brunswick*» (Therrien et al., 2000);
- comments from scientists (DFO, and P.E.I. Dept. of Fisheries, Aquaculture and Environment) and fishery officers. These comments were gathered during preliminary meetings, a workshop held to review a preliminary draft, and a final review of the preliminary report.

As such, this report does not constitute a purely scientific tool giving an exhaustive list of marine resources, but rather a planning tool for management

and conservation needs. With the assistance of multiple contributors (fishers, fishery officers and biologists), it provides a representative picture of the information currently available on major marine resources. It can be used not only for the purposes of the *Oceans Act*, but also for related objectives, such as habitat protection, or integrated fisheries management planning or ecosystem-based resource management.

DFO contracted the Genivar Consulting Group inc. and the St. Francis Xavier University to prepare this report, in collaboration with DFO managers from Moncton and Antigonish (see project team). The process leading to the creation of this document is described in the following sections, preceded by a general overview of the Southern Gulf area.

1.1 General overview of the Southern Gulf

This overview is divided into two sections: the ecological and the economic characteristics of the area.

1.1.1 Ecological characteristics

The Southern Gulf is a complex ecosystem bording the Laurentian Channel and all of its different geographical components are linked together because of the major currents, the mixing of water bodies, and its global use by marine fauna, especially migrating species which rely on all of these different components at different times annually. The major geographical components of the Southern Gulf are: Chaleur Bay, Shediac Valley, Northumberland Strait, western Cape Breton and northern P.E.I.

Chaleur Bay consists of a semi-enclosed area opening on the Gulf, which is influenced by the freshwater discharge from a number of major rivers, the most important being the Restigouche River. A cyclonic current gyre located near the mouth of the bay enhances productivity in the area (DFO, 1998a). It shelters considerable fauna (large kelp beds, 157 taxa of benthic marine algae, over 250 species of mollusc, amphipod and echinoderm, and other benthic organisms associated with nearshore muddy bottoms). It contains a particularly high zooplanktonic diversity and richness (invertebrate larvae, fish eggs and larvae). It is a migration route for numerous species (marine mammals, aquatic birds, fish such as the Atlantic mackerel, the Atlantic salmon and the Bluefin tuna, and crustaceans such as the snow crab, etc.), which take advantage of this productivity.

Shediac Valley consists of an open area having approximately the same characteristics as the Gulf. Gyres are present at either end of the valley near

the boundaries. The Miscou gyre provides the same productivity benefits as the one in Chaleur Bay. Dominant southwest winds also produce anticyclonic gyres in the Shediac Valley, which enhance fish larvae retention and promote productivity (Koutitonski and Bugden, 1991). Shediac Valley harbours all the Gulf species and also offers diversified and productive coastal habitats, notably the Miscou Bank and Miramichi Bay. As many as 78 species of fish have been observed in the Miramichi River and estuary (McKenzie, 1959).

The Northumberland Strait, 200 km long and 20 km wide, is relatively shallow (less than 40 fathoms or 64 m). It separates New Brunswick and Nova Scotia from Prince Edward Island and allows current exchanges between the Shediac Valley and the Cape Breton peninsula. It is also a productive environment, due to warmer waters and the presence of current gyres at Bay Verte and at both ends (around Point Escuminac and Pictou Island). Deep-water species are generally absent (some cetaceans, snow crab, some groundfish), but it nevertheless shelters a diverse invertebrate fauna, and is used as a migration route by numerous fish species, including anadromous species such as striped bass and Atlantic salmon.

The western coast of Cape Breton is also an area of great biological richness. At one end, St. Georges Bay is characterised by the presence of a current gyre associated with high productivity, and by the Canso Strait, which links the bay to the Scotian Shelf. The Canso Strait link was narrowed with the building of the Canso Causeway in the 1950's. At the other end, the Cape Breton trough is also an area of high productivity. With some of the deepest water in the Southern Gulf and an upwelling zone, the trough provides a major migration path of numerous species of cetaceans, fish and crustaceans.

Finally, northern P.E.I is part of the Magdalen Shallows within the Gulf of St. Lawrence. The shoal has the greatest zooplankton and ichtyoplankton diversity of the Gulf, with the highest concentrations of zooplankton and fish larvae in its western portion. It is characterised by the presence of several banks (Orphans, Bradelle, etc.) and shallows where high densities of crustaceans and fish are found (de Lafontaine et al. 1991).

1.1.2 Economic characteristics

The study area of this report encompasses two provincial jurisdictions. Thus it is difficult to characterise the economic impact of the fishery in a homogenous manner. The entire Prince Edward Island and Gulf Nova Scotia fishery is managed by the Gulf region of the Department of Fisheries and Oceans (DFO). The study area is represented by 20 DFO statistical districts, 10 in each province. The study area is also representative of three economic regions of the

Maritimes as defined by Statistics Canada. These are 1) Gulf Nova Scotia; 2) Prince Edward Island; and 3) Cape Breton Island.

As reported by DFO statistical branch, there are 2024 core fishers, 5046 non core fishers, 28 designated full-time, and 14 listed as other (lobster pound, company, or First Nations) in the study area. This adds up to 7112 registered fishers who hold a total of 17907 licenses of 26 different types.

The fishery in the Gulf region of Nova Scotia is significantly smaller than that of the rest of the province. In 1998 the total landed value of the Nova Scotia fishery reached $543 M, with the total value for the gulf portion at $50 M. The total landed value for all species in the gulf region for 1999 increased to $55 M. The landed value of all species in the province represents 2.5% of the total provincial GDP ($22 B, 1999), with the contribution of the total landed value of the Gulf region at approximately 0.25% of the provincial GDP.

The GDP for the Prince Edward Island economy was reported as $3 B for 1999. The P.E.I. total landed value of all species in 1999 reached $130 M. This represents a 4.3% contribution to the GDP for landed value of all species. The impact of the Gulf fishery on the GDP of each province is therefore significantly different. The above figures deal exclusively with landed value with the contribution of the sector as a whole, when we include exports, processing and capital investment not being represented. A 1998 report by the Oceans Institute of Canada (1998) estimates the landed and market value to be a 1:2 ratio. Using a similar estimate would effectively triple the GDP contribution of the fisheries across these two sectors (harvesting and manufacturing).

Although the species of importance in relation to both landed value and licenses are similar between the two provinces, there are key variations. Lobster is the common denominator in terms of value and licenses held. The N.S. portion of the Gulf region has 680 lobster licenses. P.E.I. has 1292 reported lobster licenses. The 1999 value of landings was just under $120 M, broken down as $88 M for P.E.I. and $31 M for N.S. In N.S., snow crab generates the second largest amount of landed value at $15 M, while the second largest value reported in P.E.I. comes from cultivated mussels ($14 M). In terms of licenses held, snow crab in N.S. is reported as 142, while mussel licenses in P.E.I. number 246. Herring ranks as the top pelagic species in both provinces in terms of value and licenses. N.S. has 425 commercial licenses and 488 bait licenses. The numbers in P.E.I. show 863 commercial licenses, the number of bait licenses is listed as 1033. The 1999 value of the herring fishery is listed as $2 M for N.S. and $4 M for P.E.I.

The Nova Scotia Gulf fishery and the P.E.I. fishery share similar organisational attributes, particularly with the dominance of the smallboat inshore fishery (< 45 ft or 13.75 m). 1999 DFO statistics show that 99.5% (2279 of 2289) of vessels fall within that category. The < 45 ft category is synonymous with the inshore fishery and *bonafide* fishers. Thus it would be fair to characterise the Gulf fishery of N.S. and P.E.I. as such a fishery; 66% of the Gulf N.S.-P.E.I. fleet fall within the 40 ft-45 ft. category, 16% range from 35 ft-40 ft., while another 17% are listed in the < 35 ft category.

The importance of boat size as an indicator of the fishery pursued links fishers to community. The link between homeport, informal organisation and regulation of the inshore fishery around a coastal community cannot be understated. The social aspects of the inshore fishery are tradition-bound and rooted in small coastal communities that exist around homeports. This type of informal organisation is often referred to as Customary Access Right (CAR) or Territorial Use Resource Fisheries (TURF) in sociological literature. The customary or traditional aspect of the fishery is one that sees intergenerational linkages to the fishery. Customary access suggests that the informal regulation of fishery is an understanding among fishers in a given community about who fishes where on the local fishing grounds.

Aboriginal fishing in the study area occurs from bands in both Provinces. The Afton band and the Pictou Landing band are located near ports in N.S. The Lennox Island and Abegweit Bands are located near ports in P.E.I. The Lennox Island band and the Native Council of Prince Edward Island (NCPEI) have 20,000-pound quota of lobster harvest for food, social and ceremonial purposes. As of June 30, 2000 the Afton Band had 3 commercial lobster licenses. Pictou Landing holds 8 commercial lobster licenses and Abegweit holds 5 commercial lobster licenses. These numbers will change over time as new agreements are reached between DFO and First Nations Bands.

2. METHODOLOGY

2.1 Selected themes

The project team at DFO selected four themes for its description of significant habitat, which are:

- Ecological features
- Vulnerability, threats and human pressure
- Socio-economic characteristics
- Support, favourable and unfavourable factors

Under "Ecological features", each habitat is described in terms of its role, ecological value, particularities (particular species or communities, rare or endangered species status) and ecosystem characteristics. These include the type of habitat or ecosystem (spawning ground, nursery area, feeding area, nesting area, lagoon, marsh, estuary, etc.) and major biotic (productivity, breeding, etc.) and abiotic (currents, erosion, etc.) processes.

"Vulnerability, threats and human pressure" focus on the potential problems related to the conservation of the habitat. It puts in perspective its vulnerability (fragility, sensitivity, scarcity, isolation, etc.) and its components of interest. In addition, a description and, if possible, an evaluation of anthropogenic (human) factors (pollution, exploitation, navigation, etc.) which threaten, disturb, have disturbed or could disturb habitat integrity are also included.

The theme "Socio-economic characteristics" briefly describes the human presence in the area, including uses of the resources and occupation of adjacent territories. It mainly focuses on commercial fishing activities, altough other economic (different operations including industrial, tourism, navigation, etc.) and leisure activities (pleasure boating, scuba diving, etc.), government jurisdictions, native claims, etc. are also described.

Finally, the theme "Support, favourable and unfavourable factors" reviews the context (proximity of other protected areas, economic constraints, logistic problems, etc.), and lists the individuals and organisations who would be in favour of or against changes in status (e.g. the creation of MPA's) or changes in

resource management (e.g. integrated, coastal or ecosystem management) of the habitats involved.

2.2 Data collection

Data for this report was gathered in three stages: by consulting DFO and provincial government researchers and fishery officers, by a literature review and by a workshop involving mostly researchers and managers.

2.2.1 Meetings with researchers and fishery officers

DFO and provincial government (P.E.I., N.S.) researchers and DFO fishery officers were consulted or interviewed to propose significant habitats on the basis of specific species. Discussions were mostly based on ecological features and on vulnerability and pressures.

2.2.2 Literature review

A literature review was also undertaken to document some of the statements made by researchers. Documents included primarily DFO stock status reports, which describe the state of a given species in the Southern Gulf, DFO research reports, which describe different aspects of a given species (biology, population trends, vulnerability, etc.)and particular habitats of the concerned resources, and DFO landing statistics, which provided the information used to describe the socio-economic importance of each significant habitat. The location of areas was also obtained from the atlas entitled "Traditional Fisheries Knowledge for the Southern Gulf of St. Lawrence" (J. Lee MacNeill & Associates, 1998 (marine), 2001 (nearshore)), which presents an overview of fishers' traditional knowledge of the distribution of marine resources in the area. Among other reports useful for many species was the series of reports done on the St. Georges Bay ecosystem project, notably Davis et al (2000), and the report on essential habitats of northeast N.B. (Therrien et al., 2000).

2.2.3 Workshop

A workshop was held on June 7th 2001 in Moncton where comments from researchers (DFO and P.E.I. departments) and DFO managers were gathered to refine significant habitat locations for some areas, and to complete the information on all topics. New regionally significant habitats were also discussed and added.

2.3 Significant habitats

The information in this report is presented in the form of regionally significant habitats for certain marine species. A significant habitat usually means a "species-habitat", i.e. a vital habitat in the region for a given species. The sites identified are significant habitats for important life stages (e.g. spawning, nursery, migration, overwintering, etc.), or high-density habitats for less mobile species such as molluscs, for which area boundaries remain relatively constant from one year to the next.

High fish concentration areas were usually not included, except for areas associated with specific life stages (larval or juvenile), areas of high concentration of a stock that is rebuilding, such as Atlantic cod, or areas of high concentration of a species of high interest (tuna) which are recurrently into the Gulf only for a specific purpose (feeding). The same applies to other species like crustaceans, which are mobile and can be found almost everywhere depending of the season. Because the identification of particular habitat is a major objective, one needs to discriminate between general areas to identify smaller specific areas related to a life-stage or a particular feature. A good example is the lobster, a ubiquitous species throughout the area. Lobsters leave deeper areas in spring to migrate in shallow waters in all coastal regions of the Southern Gulf until the fall. The mapping of high densities of lobster would cover almost all of the coastal regions. Thus, it was chosen to identify areas where high concentrations of female or larger-sized lobsters were found, as well as area of high density of larvae. This does not imply that all other shallow areas are not used, nor important for the species. Densities alone were not used to discriminate between regions in this example.

Besides species-habitat groupings certain habitats were identified because of their great biodiversity and/or because of specific ecosystem features. Some of them, like the Pictou or St. Georges Bay, have already received the attention of researchers or conservation groups, while others, like Basin Head, are already proposed by DFO to receive special protection measures under the Marine Protected Area program.

The majority of the species-habitat identified describes species having a commercial or recreational interest and for which there is usually more data available. The list is not comprehensive and is a function of the level of information available. In some cases, even for some commercially harvested species, there was no information available. For others, such as eel, cod and American plaice, known spawning habitats are located outside of the study area. Non commercial species have been less studied even if, in some cases,

they are known to be important elements in the food chain and key links between trophic levels.

Some of the marine resources are not included because of their widespread distribution. They are omnipresent and it is difficult to identify a habitat of particular importance. Some kelp beds, small aquatic bird colonies, and small concentrations of pinnipeds or molluscs (especially the soft-shell clam and the blue mussel) are good examples of such resources. Quality habitats such as estuaries are also not thoroughly presented, given their number along the Southern Gulf of St. Lawrence. In spite of their large numbers, these habitats should be taken into consideration because of their high productivity and of their ecological importance for a number of marine species.

Significant habitats are presented in two sections. The information about the first group of significant habitats is presented in a "Fact Sheet" format as described in section 2.1 (selected themes). These habitats are included in this section because of their relative "significance". A second group of habitats, important but to a lesser degree, are also identified on maps, followed by a brief description, in the appendix. In fact, all fish habitats are important, significant or key to the species that use them, and overall they constitute the unique ecosystem of the Southern gulf of St. Lawrence. The authors acknowledge that this representation is somewhat anthropocentric, in that it highlights only commercial species, and biased, in that it weighs significance based on "arbitrary" factors. But as for any other planning tool, this report only presents partial answers to our questions. It also contains elements of information that will help to achieve better management of the ocean's resources and human activities, based on an ecosystem approach. It is hoped that the fact sheet format used in this document will facilitate its updating when additional information is obtained. This report is intended to be a "living document", and as such it only presents a snapshot of the information readily available at this time. It will be updated as often as required.

Data for landings and landed value for specific species was derived from statistical information provided by DFO and the NAFO Statlant 21A data series. It was estimated for the area encompassing a significant habitat with the closest adjacent stastical district (or districts) associated with fishing effort directed at a particular species (i.e. the information was condensed to try to represent the actual landing and value of a fishery located among one or several statistical districts as they correspond to the fishery in a specific area or statistical district, as opposed to the entire region). Native fisheries landings and values were not included because of the scarcity of data available at this time.

3. REGIONALLY SIGNIFICANT HABITATS

This chapter contains information, in fact sheet form, on the species habitat association of 35 habitats described according to the four themes developed in section 2.1. In addition, at the end of every fact sheet, a list of associated significant habitats (described in other fact sheets or in an appendices) is provided for the same habitat, as it pertains to another species. A list of other significant habitats for the same species is also provided.

Five major species-habitat categories are included, i.e. habitats associated with the following groups: vegetation (3), fish (14), crustaceans (1), molluscs (7) and marine mammals (3). In addition, habitats (7) known for their high productivity are included.

Other significant habitats

As described in section 2.3, other habitats are also identified and are grouped by species in appendix A, where each habitat is briefly described and situated on a map. Appendix B lists the scientific names of the species mentioned throughout the report, appendix C lists the stakeholders interviewed, and appendix D lists the participants present at the scientific review workshop.

Please note:

The nature of the information presented in these pages is very dynamic and changing. The maps presented in this report should be interpreted with caution as they try to illustrate ecological realities that are in constant evolution and for which we often have only partial knowledge.

The information on fishing seasons is both actual and approximate. An example of actual would be lobster; it is static in many areas, rarely changing except for variations because of ice conditions. Species such as tuna, groundfish and herring are managed by quota. Once the quota is filled the season is over, leading to greater variability year to year. The number of licenses represents the total registered, in some fisheries a license is held but not active. These numbers provide information on the number of individuals by fishing activity and not the fishing effort (e.g. gear density). A same fisher may be engaged in a number of fisheries. This information should only be used to assess the relative importance of the area for the fishers.

3.1.1 Eelgrass beds around P.E.I. and western N.S.

Ecological Features

- Eelgrass is found in high concentrations in sheltered areas such as barachois, lagoons and sheltered bays with gentle slopes and fine substrate. [v1] In the Southern Gulf, they are found in shallow water (approx. 0-3 m), from the intertidal zone to the limit of the photic zone. No mapping of this resource has been done because of its ubiquity except for P.E.I. where mapping with the help of a Geographical Information System (GIS) is currently under way. [v2]
- Eelgrass beds are known for their high primary production and are a key element in the coastal food chain. [v1]
- Eelgrass provides food and shelter for invertebrates and small fish (stickleback, killifish, mummichog and silverside), as well as many large fish (e.g. herring, winter flounder, sculpin, white hake and mackerel) during their juvenile stages. [v1] White hake is closely associated with eelgrass beds during its lifestages. For instance, nursery areas for White hake have been identified where eelgrass beds are found (fact sheet 3.2.13).
- A number of species, such as herring, deposit their eggs on the eelgrass substrate. [v1]
- It is also an important source of food for many birds such as Brant geese and various species of ducks. [v1]

Vulnerability, threats and human pressure

- Some areas are threatened by human activities such as infilling, drying out or trampling.
- Disease or climatic changes wiped out large concentrations of eelgrass in the early 1930's. [v3]

Support, favourable and unfavourable factors

- Eelgrass beds are an important habitat for many species at various stages in their lives.
- Eelgrass beds can be used as environmental indicators. For example, an abundance of nutrients will contribute to the accelerated growth of eelgrass.

Other associated significant habitats

- Eelgrass beds constitute a significant habitat included in a fact sheet for: white hake (3.2.13).

References

V1: DFO (MPA Laurentian Region) 1998a

V2: Rasmussen, 1977

V3: Glyn Sharp, DFO, Dartmouth (N.S.)

3.1.2 High concentrations of Irish moss on the west coast of P.E.I. and in Gulf N.S.

Ecological Features

- Irish moss, a red algae found throughout the Southern gulf of St. Lawrence, can be found on the coast of P.E.I., and in Gulf N.S. between Amet Sound and Mabou Harbour (figure 3.1.2). [3-6] Major beds are found mostly on the West Shore, between North Cape and Cascumpec Bay, and on the east shore of Egmont Bay, in P.E.I., and also between Amet Sound and Caribou Island in N.S. [3]
- Irish moss is found on all types of substrate except fine and the density of moss is related to the proportion of sandstone ledges. [4] Irish moss is found at depths of less than 10 m. However, it is most common at depths of less than 5 m with the average depth of Irish moss growth being at about 3 m. [4] When it comes to commercial harvest, the density is insufficient for this practice under 7 m. [4] The percentage of moss on the harvested beds varied from 10 to 27% of the surface. [4]
- Irish moss, because of its morphology, supports dragrake harvesting better than other algae. This leads to an increase in Irish moss proportion on harvested algae beds. The size of Irish moss beds can also increase if the crop at the margins is harvested. [4]
- Irish moss is harvested mainly because it contains substantial concentrations of carrageenan, a thickening agent that is used notably in ice cream and many other dairy based products as well as jellies, aspic, salad dressing, beer, insect sprays, water base paint, shampoos, toothpaste and cosmetics. Irish moss is also used as an ingredient in soup and in sea salad, a very popular meal in Japan. It was traditionally used as a natural medicine for its expectorant, demulcent, antitussive and anti-inflammatory properties. Recently, other characteristics have been discovered, notably anti-viral and anti-coagulant properties.
- The Irish moss beds also support other kinds of aquatic plants. For example, at least 17 different species, mostly fine reds, are found growing in Irish moss beds. [4]
- Irish moss provides food and shelter for invertebrates, including juvenile lobster and small fish, as well as larger species of fish during their juvenile stages. [7]
- In the 1970's, the western shore of P.E.I. harvested more Irish moss per kilometre than anywhere else in Canada. [4]

Vulnerability, threats and human pressure

- Some areas are threatened by human activities such as landfilling, drying out or trampling.
- Polluted coastal areas would restrain people from using this resource for nutritive or medicinal purposes.
- There is grazing by littorina (gasteropod) and green sea urchin, and high densities of these species may reduce or contribute to the reduction of Irish moss beds. Other possible scouring may be done by ice, dragrakes and rocks (moved by ice or water surge). [v4]
- During harvest, it is important not to remove the holdfast, a section of the plant, which is equivalent to the root. The holdfast is necessary for the plant to remain attached to the friable sandstone and is also responsible for annual recruitment. In the 1970's, up to 35% of fronds had their holdfast removed during commercial harvest in the Southern Gulf. Design modification of the dragrakes (addition of runners and spacing of rack tooth to a minimum of 7 mm) have helped to reduce this proportion. [v4,v7]

Socio-economic characteristics

- Irish moss is of high economic importance to P.E.I. It ranks fourth in landed weight and eigth in landed value of all species for 1999. Statistics for landed weight and value began to appear in the 1940's [v6] and quickly established Irish moss as a dominant position in both these categories. In the 1970's, three quarter's of the world's production was provided by the Maritimes with P.E.I. producing half of it, with Irish moss' economic value being only second to lobster. [v7] Since then, cheaper sources of caraageenan from asian suppliers have contributed to a reduced demand for Canadian Irish Moss.
- Irish moss is harvested with dragrakes. However, when tides, storms or wind tosses the seaweed close to shore or on beaches it may still be gathered by horse.
- NAFO 21A statlant data series does not include landings specific to Irish moss, therefore this data will not be presented as per other sections. Instead, the landings data series provided by DFO for 1990-99 period will be presented. The following is the landings data for Irish moss for all districts of the Southern Gulf: 1990-16,722t ($4,141,006); 1995-9,134t ($1,676,345); 1999-6,248t ($1,151,229).
- Irish moss landings throughout the 1980's are reported in six different districts, with the dominant landing districts being 82, 88 and 92. Landings in district 88 tapered off through the 1980's (from a high in 1983 of 5,784t to 155t in 1989). In the early 1990's landings were reported in the western districts of 82, 83, 92 and 95, however by 1996 landings were only reported in districts 82 and 92. During the period between 1980-1999, landings in district 82 were the most dominant.

- As Irish moss landings have occured mostly in statistical districts 82 and 92, only data related to these are presented.

	10 year means (1990-99)		1999 landings	
	(metric tonnes)	($000)	(metric tonnes)	($000)
District 82	6,451	1,282	4,586	847
District 92	908	187	1,602	293
All districts	7,780	1,565	6,188	1,140
Gulf N.S. and P.E.I.				
Entire Gulf	7,904	1,588	6,248	1,151

- 301 licenses were registered in P.E.I. for seaweeds in 1999. 149 of these were registered in district 82 and 112 were registered in district 92. 40 were registered for the remaining 8 districts and 35 of these occured in district 83.

- Other than Irish moss, important commercial species in statistical district 92 are (1999 landed value order over $100,000):

Species	Value ($000)	Licenses (valid)	Season
Lobster (LFA 24)	16,811	272	May 1- June 30
Snow Crab (Area 12)	3,495	16	July- Sept.
Herring	1,175	478	August- Oct.
Mackerel	857	285	May- August
Cod (3PN, 4R, 4T, 4S, 4VN)	730	198 (groundfish unspecified)	Varies
Bluefin Tuna	337	100	July-Nov.
Oyster	263	200	Sept. 15-Nov. 15
Softshell Clam	254	161	Summer

Support, favourable and unfavourable factors

- Basis of an important commercial fishery on the P.E.I. coasts.
- Irish moss beds provide habitat for juvenile lobster and other commercially harvested species.
- May benefit from MPA project at Basin Head i.e. transfer of seed stock for aquaculture.
- Miminegash Natural Area is adjacent to this concentration.

Other associated significant habitats

- Irish moss beds location are also significant habitat included in fact sheets or appendix for: herring (3.2.3, 3.2.5, 3.2.8, 3.2.9), mackerel (3.2.10), white hake (3.2.12, 3.2.13), lobster (3.3.1), grey seal (3.5.1), harp seal (3.5.3), St. Georges Bay (3.6.3) and Basin Head (3.6.7), as well as grey seal (in appendix).
- Irish moss is not associated with other significant habitat in this report.

References

V3: G. Sharp, p.c. 2001

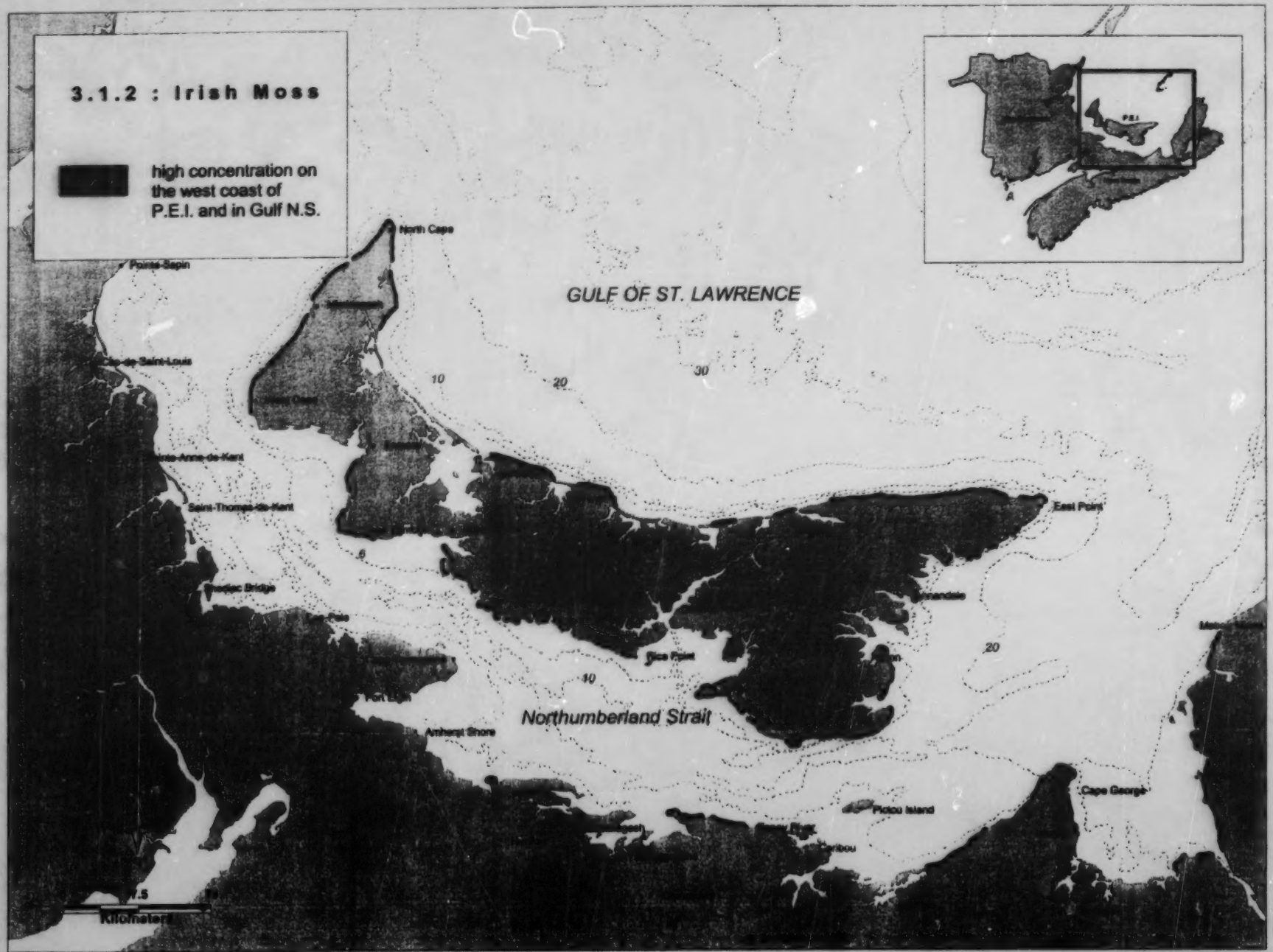
V4: Pringle and Semple, 1983

V5: C. Poirier, p.c. 2001

V6: D. Cairns, B. MacInnis and L. Murphy, p.c. 2001

V7: Bell, 1990

V8: DFA, 1991


3.1.2 : Irish Moss
high concentration on the west coast of P.E.I. and in Gulf N.S.
North Cape
Pointe-Sapin
GULF OF ST. LAWRENCE
10
20
30
East Point
Northumberland Strait
Amherst Shore
Pictou Island
Cape George
Kilometers

3.1.3 Spartina salt marshes around P.E.I. and western N.S.

Ecological Features

- Spartina, a large aquatic plant (macrophyte) mainly found in salt marshes, grows in the shallow waters of the intertidal zone in estuaries, barachois, lagoons, and behind barrier islands. No mapping of this resource has been done because of its relative abundance and broad distribution. However, a study covering this habitat is under way for P.E.I. [8]
- Spartina, like other macrophytes found in salt marshes (eelgrass, scirpus, salt marsh, and mucilaginous algae), have a high primary production leading to an evenly higher secondary production. These high rates of production make the Spartina marshes a key element in the coastal food chain. [7]
- Salt marshes are used as spawning, nursery, feeding and resting habitat for a number of freshwater, anadromous, catadromous and pelagic fish. They are essential for the fish production of many species, including sticklebacks. These rich habitats are also frequented by juvenile tomcod and rainbow smelt. High densities of winter and smooth flounders are found in the mud flats, which are associated with these marshes. Spartina salt marshes export a large quantity of nutrients into adjacent coastal habitats, which is important for the nutrition of various species found in the higher levels of the food chain. These habitats are also very important breeding grounds for waterfowl. Furthermore, they play a crucial role when it comes to water quality since they have an important water filtering capacity. [7]

Vulnerability, threats and human pressure

- Many marshes are threatened by human activity such as trampling, drying out, and landfilling. The rising commercial value of coastal real estate has increased the pressure on these fragile habitats.

Support, favourable and unfavourable factors

- Spartina salt marshes represent an important habitat for many species at various life stages, including the juvenile stage of several commercial fish species.

Other associated significant habitats

- Spartina salt marshes constitute a significant habitat for several species of fish, molluscs and aquatic birds, although no specific fact sheet has been prepared in this report.

References

V1: DFO (MPA Laurentian Region) 1998a

V3: G. Sharp, p.c. 2001

3.2.1 Capelin spawning ground in St. Lawrence Bay

Ecological Features

- Spawning ground in St. Lawrence Bay [61,62] (figure 3.2.1). This is the main known capelin spawning ground for the Gulf N.S. and P.E.I., but its boundaries are approximate. Note that the limit of the area covered by this report ends at the east border of St. Lawrence Bay. Spawning occurs on the beach, on sandy or fine gravel bottom and in shallow water, usually in June-July. [63]
- Capelin stock distribution has traditionally been mostly in the northern part of the gulf, but the cooler waters of the last decade have induced an expansion of the stock in the Southern Gulf since 1990. In general, the stock is still more abundant in northern parts of the Gulf. [61,62] Similar occurrences of capelin in unusual areas since 1990 have coincided with temporary cold water temperatures, reduced growth of fish [63], and delay in the spawning. [64] Changes in the distribution of this stock may occur in the coming years. There seems to be a reversing of this trend whereby a scarcer distribution of capelin in Division 4T (see map in appendix) and an increased length of individuals has been observed since 1998. [65]
- Even though the species is not highly harvested in the 4T Division, catches of capelin in the groundfish surveys are substantial in the trough along the east coast of Cape Breton. [66]
- St. Lawrence Bay is a productive habitat for the growth of several species of fish, and is a known spawning ground for herring (fact sheet 3.2.6).
- It is also a migration route for certain whales and several species of fish (mackerel, flatfish, cod, tuna, etc.), that use the area as a feeding ground.

Vulnerability, threats and human pressure

- Capelin is sensitive to water temperature fluctuations (e.g. expansion to the south caused by a cooling of Gulf waters [62, 63]), and is prey for several species of fish, aquatic birds and marine mammals. Capelin stocks are therefore likely to fluctuate along with the stocks of these species, although the impact of predation on the stock or the recruitment is unknown. [64]
- Harvesting and overfishing lower trophic level species that are at the base of the food web can affect the overall productivity of an area. Fishers and scientists worry that the growth of the capelin fishery in the Gulf could hurt the recovery of the Atlantic cod stocks by eliminating one of its important food sources. [66] It should be noted, however, that commercial catches of capelin represent only a small proportion of the mortality caused by its numerous predators (marine mammals, aquatic birds and piscivorous fish). [67]

- The highest evidence of oil spill related to ballast water exchange is found near Cape North in the Southern Gulf. [c8]

Socio-economic characteristics

- There is no commercial capelin fishery in Bay St. Lawrence area and no licenses exist for capelin in the area. There are only 2 capelin licenses listed for the entire Southern Gulf Region. Both are registered in N.B.
- NAFO Division 4T landings [c9] for capelin: (1975) 105t, (1980) 1,566t, (1985) 488t, (1990) 153t, (1995) 46t, and (1999) 166t.
- There are no reported landings of capelin in the study area (Gulf N.S. and P.E.I.) for 1999. The only Gulf district (see map in appendix) to report capelin landings is district 65 in N.B. (1991, 1994, 1997, 1998, and 1999). In the mid-1800's, the decline of Atlantic cod stocks was linked to the decline of its main preys: herring and capelin. [c10] The capelin fishery in other parts of the Atlantic has expanded quickly at the end of the 1970s with the arrival of an Asian market for roe. [c8]
- Important commercial species in district 1 include:

Species	Value ($000)	Licenses (valid)	Season
Snow Crab (area 19)	3,152	29	July-Sept
Lobster (LFA 27)*	1,006	47	May 15-June 15
Cod (3PN, 4R, 4T, 4S, 4VN)	295	40 (unspecified groundfish)	Varies
American Plaice (3PN, 4R, 4T, 4S, 4VN)	158	40 (unspecified groundfish)	Varies

* Maritime Region managed

Support, favourable and unfavourable factors

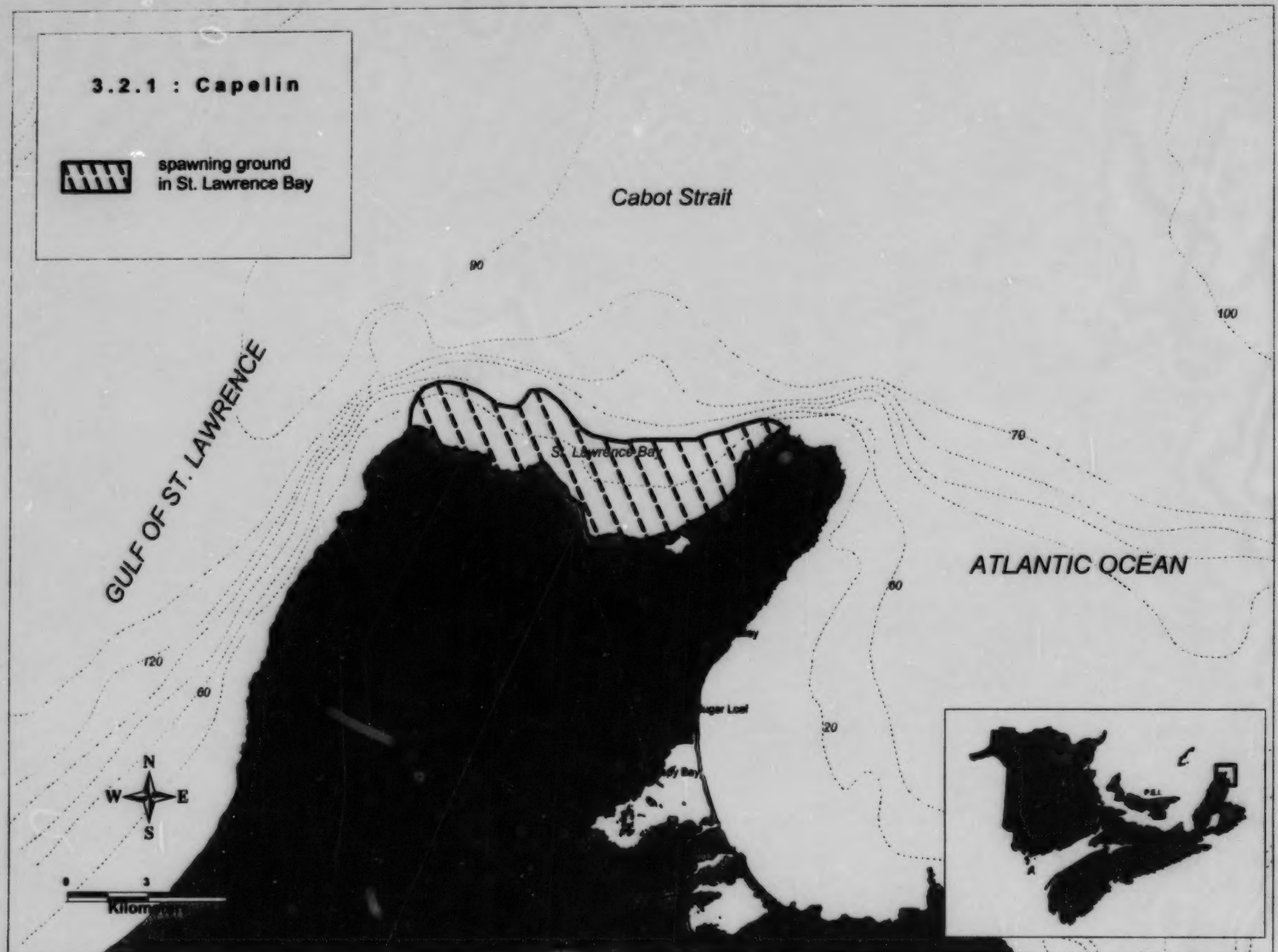
- Adjacent to Cape Breton Highland National Park.
- Lobster fishers view capelin as a nuisance, an alternate source of food to their bait.
- Federation of Groundfish Fishermen and others may support this area due to importance of capelin to groundfish species such as cod.
- Since whales prey on capelin, whale watching tour operators could also favour the protection of this habitat.
- St. Paul's Island located north of the bay is a national wildlife area and an important bird area.
- This area would benefit from an ecosystem-based management approach.

Other associated significant habitats

- St. Lawrence Bay is a significant habitat included in fact sheet for: herring (3.2.6).
- The capelin is not associated with other significant habitats in this report.

References

C1: J.-L. Beaulieu, p.c. 2001
C2: G. Aucoin and J.A. MacIntyre, p.c. 2001
C3: DFO (capelin), 2001d
C4: F. Grégoire, p.c. 2001
C5: Grégoire et al., 1997
C6: White and John, 1997
C7: F. Grégoire, p.c. in Therrien et al. (2000)
C8: K. Davidson, p.c. 2001
C9: NAFO, 2000
C10: Perley, 1852


3.2.1 : Capelin
spawning ground
in St. Lawrence Bay
Cabot Strait
GULF OF ST. LAWRENCE
ATLANTIC OCEAN
St. Lawrence Bay
90
100
70
60
120
60
20
N
W
E
S
0
3
Kilometers

3.2.2 Atlantic cod nursery in the Shediac Valley and north of P.E.I.

Ecological Features

- There is a concentration of juvenile Atlantic cod in the Shediac Valley and north of P.E.I., according to inventory data [d1-d5] (figure 3.2.2). The area boundaries are approximate and are dependent on annual and seasonal variations in distribution, as well as sampled areas (e.g. shallower waters, less than 10 fathoms (16 m), were usually not sampled). This area is modified from what was presented previously in the northeast N.B. 2000 report [47].
- Juveniles, generally less than 45 cm in length and aged 3 years and less (sexual maturity is reached between 3 and 7 years of age), are mostly concentrated in three areas: Shediac Valley, north of P.E.I. and north of the Magdalen Islands. [d2,d4] Juveniles are also found in Chaleur Bay [d2,d3,d5,d8,d9], but in lower concentrations and mixed in with a higher number of adults. [d2] Juveniles are usually found at depths of between 12.5 to 43.5 fathoms (20 m and 70 m) [d9], and less than 31 fathoms (50 m) for younger year-classes (< 3 years). [d3]
- Juvenile concentrations are higher in the southern part of the Shediac Valley [d1-d3, d5,d6, d8, d10], particularly for young less than 2 years old, especially around a current gyre at the entrance to Northumberland Strait. This current gyre concentrates the nutrients and the plankton, and attracts species at higher trophic levels.
- The proportion of the Atlantic cod biomass found in the southeastern part of the Gulf is greater than before. [d11] The abundance of the population, however, remains low. [d11, d12, d13, d14]
- Shediac Valley is a highly productive area, used notably as a nursery area for juvenile Atlantic herring (fact sheet 3.2.7).

Vulnerability, threats and human pressure

- Cod is considered as an endangered species, according to COSEWIC.
- The stock was in sharp decline in the early 90's. The closure of the fishery in 1993 halted this decline but the stock has not increased since 1993. [d13] Although a directed fishery for cod re-opened in 1999, the TAC is much reduced from the pre-moratorium days. There is an indication that the stock has not recovered and is still less than 50% of a 200,000t average spawning biomass level. [d13,d14]
- Because of less abundant year-classes in recent years, 1998 being the poorest on record, the stock should not increase in 2001 even without fishing, and a reduction of stock spawning biomass is predicted if the current

6,000t TAC (cod-directed, by-catch, sentinel and recreational) is continued. [d13]

- Recruitment **rate** estimates (recruits per unit of spawning biomass) in recent years range from the average levels of the 50's to early 70's period to relatively high levels. [d15] Although the recruitment rate is good, the underlying spawning biomass is low which results in fewer recruits than if biomass was average. This combined with low growth rates and unusually high adult natural mortality rates [d15] has resulted in the stock remaining at a low level despite the low fishing mortality (restricted fishery). The latter would be the main difference compared to the period following the precedent mid 70's stock decline when the recovery was rapid. The pelagic fish biomass, which was high in the recent years, and very low in the late 70's when the rapid recovery happened, may also have had a strong influence; a lower biomass of some pelagic fish (herring, mackerel) may reduce the predation and the competition on cod juveniles. [d16,d17] Unreported catches may also be added to the possible causes. [d2]
- Bottom trawling and dragging has a harmful effect on groundfish habitat by flattening the bottoms [d18], which could favour juvenile predation. Ice can have the same effect but on a larger scale.
- The harvesting or overfishing of species that are prey to other commercially exploited species can affect recruitment. Fishers and scientists worry that the growth of the capelin fishery in the Gulf could hurt the recovery of the Atlantic cod Northern Gulf component of the stock by eliminating one of its important food sources. [d19] There is also a doubt about the recovery of the cod stock east of Newfoundland if the capelin stock does not improve. [d20]
- The fishing industry has questioned the relationship between seal predation and high natural cod mortality. This remains a source of uncertainty but recent analyses do not indicate that this is an important mortality factor. [d16] Although the seal consumption of cod in Division 4T (see map in appendix) may be substantial, in the order of 5-13 thousand tonnes annually, this estimate is still to be confirmed because little is known of the variation in the seal diet in the Southern Gulf. [d21]

Socio-economic characteristics

- Cod was the single most important species of the historic fishery as exploitation of Gulf of St. Lawrence cod dates back to the 16th century or even earlier. The fishery was prosecuted by many European nations and was a factor that led to the establishment of French and English settlements in much of present day Atlantic Canada. [d22]
- Fishing was first practised with lines and fishhooks, until the end of the 40's when the ban on the use of trawls was lifted. In the 80's, the use of fixed

gear declined and mobile gear was used until the fishery was closed in September 1993 due to low stocks. [83]

- NAFO Division 4T landings [84] for cod: (1975) 28,048t (1980) 36,157t (1985) 47,819t (1990) 41,552t (1995) 1,031t and (1999) 6,171t.
- The fact sheet 3.2.2 cod harvest within the report area mainly occurs in statistical district 92 (see map in appendix).

	10 year means (1990-99)		1999 landings	
	(metric tonnes)	($000)	(metric tonnes)	($000)
District 92	449	377	441	729
All districts Gulf N.S. and P.E.I.	4,701	3,678	2,143	3,411
Entire Gulf	6,761	5,162	3,182	4,632

- There is a substantial fishing done by the Acadian Peninsula fleet in that district and, therefore, the landings in district 92 do not reflect the actual harvest. Cod was under moratorium from September 1993 to 1999. Landings during this period were a result of by-catch and sentinel fisheries (267t, 210t, 56t, 35t, 67t, and 123t: 1993-98).
- Cod was re-opened as a directed fishery in 1999. In 2000 and 2001 TAC was set at 6,000t. There are 198 groundfish licenses in district 92 with 106 boats reported active in 1999.
- There are other important commercial species besides cod that are landed in statistical district 92. These species are (1999 landed value order over $100,000):

Species	Value ($000)	Licenses (valid)	Season
Lobster (LFA 24)	16,811	272	May 1- June 30
Snow Crab (Area 12)	3,495	16	July- Sept.
Herring	1,175	478	August- Oct.
Mackerel	857	285	May- August
Bluefin Tuna	337	100	August-Nov.
Irish Moss	293	112	Summer
Oyster	263	200	Sept.-Nov.
Softshell Clam	254	161	Summer

Support, favourable and unfavourable factors

- Some cod fishers could favour a new management or protection status for the Shediac Valley area.

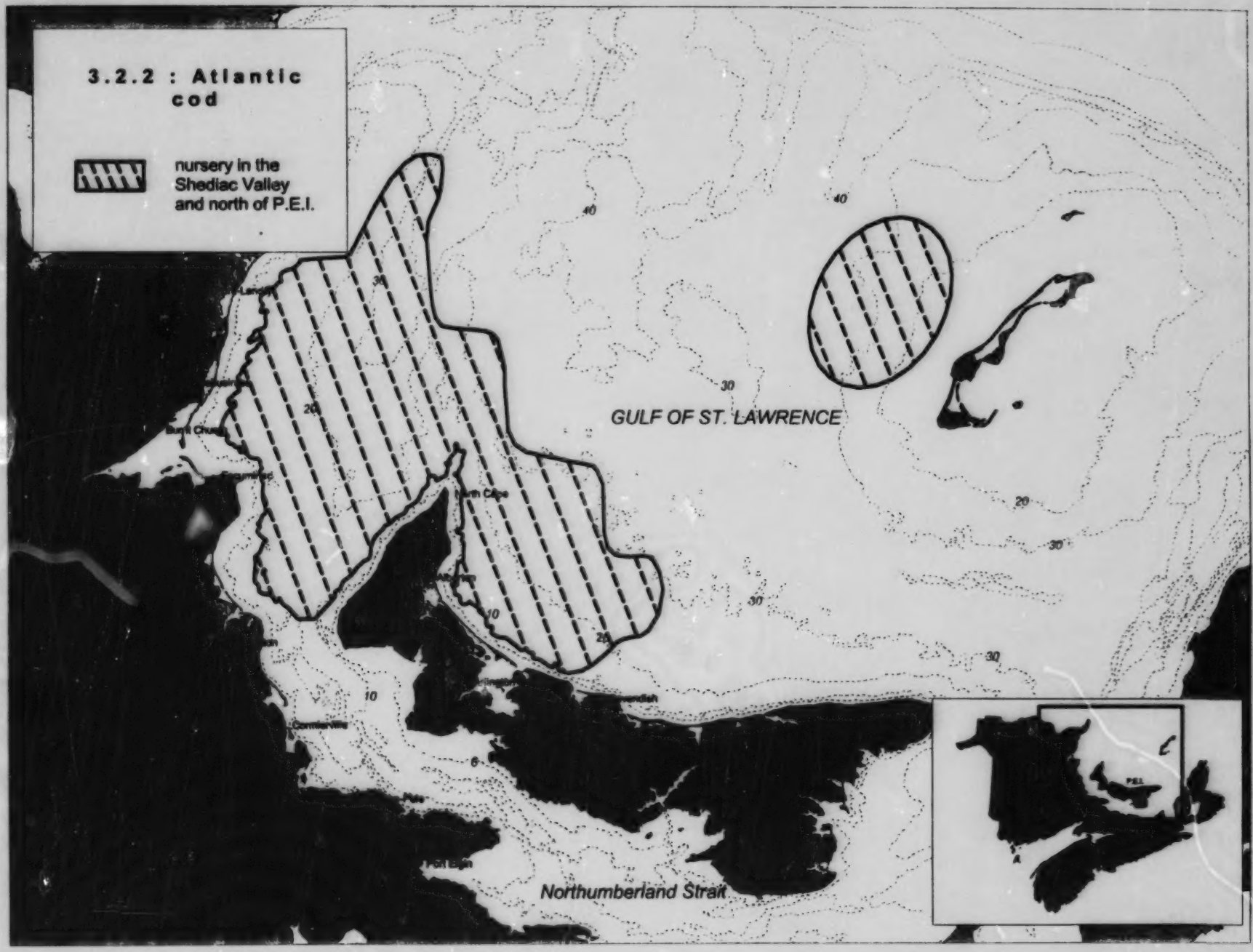
- Capelin fishers may be opposed to a different management or protection status for the Shediac Valley area.
- Scallop fishers could also oppose changes in management or protection in the Shediac Valley area.
- This site covers an area with multiple jurisdictional interests.

Other associated significant habitats

- Shediac Valley and north of P.E.I. are significant habitats included in fact sheets or appendices for: Atlantic herring (3.2.5, 3.2.8 and 3.2.9), Atlantic mackerel (3.2.11), bluefin tuna (3.2.14), sea scallop (3.4.7), hooded seal (3.5.2), and harp seal (3.5.3), as well as rock crab, surfclam and grey seal (see appendix).
- Atlantic cod is not associated with other significant habitats in this report. However, there is a relatively high abundance of juveniles in Chaleur Bay, and a high concentration of adults on Miscou Bank (see the northeast coast of New Brunswick report [47]).

References

D1: Chouinard et al., 1990
D2: Chouinard et al., 1991
D3: Hanson, 1996
D4: Sinclair et al., 1998
D5: Swain, 1999
D6: Tremblay and Sinclair, 1985
D7: Therrien et al., 2000
D8: Chouinard and Sinclair, 1989
D9: Swain, 1993
D10: Swain and Poirier, 1997
D11: Chouinard et al., 1998 (groundfish)
D12: Chouinard et al., 1999 (groundfish)
D13: Chouinard et al., 2001 (cod assessment)
D14: Poirier et al., 2000 (cod assessment)
D15: Swain and Chouinard, 2000
D16: Swain et al., 2000
D17: Swain and Sinclair, 2000
D18: Watling and Norse, 1998
D19: White and Johns, 1997
D20: Driscoll et al., 2000
D21: Hammill et al., 1999
D22: Innis, 1954
D23: DFO (cod), 2001a
D24: NAFO, 2000


3.2.2 : Atlantic cod
nursery in the Shediac Valley and north of P.E.I.
GULF OF ST. LAWRENCE
Northumberland Strait
40
30
20
10
6
P.E.I.

3.2.3 Atlantic herring fall-spawning ground from Arnet Sound to St. Georges Bay

Ecological Features

- Fall-spawning habitat for Atlantic herring is located along the coast between Arnet Sound and St. Georges Bay [h1,h2,h3] (figure 3.2.3). Fall-spawning grounds are usually found at depths between 3 and 12.5 fathoms (5-20 m) [h4], but they can reach as deep as 15.5 fathoms (25 m). [h2]
- This site is one of the major fall-spawning areas near the Gulf coast of N.S. and around P.E.I. Other spawning areas are Fisherman's Bank and The Ridge (fact sheet 3.2.4) and North Cape (3.2.9). [h2,h5]
- Herring fall-spawning times are stable and occur mostly in September. In fact, between 1986-97, the date at which 50% of the catch was made in the Pictou area has varied between September 9 – 23. [h7] Generally, the spawning starts at the west end of the area and ends in St. Georges Bay.
- The main fall-spawning stock for the entire Southern Gulf is located in Chaleur Bay. The stocks of Pictou, Fisherman's Bank and Escuminac-west of P.E.I. are almost equal at second rank. [h4,h5]
- The fall-spawners stock abundance remained high in recent years, and new high abundance year-classes (1995 and 1996) are now supporting the fishery. [h5] The estimated biomass of aged 4+ herring (by convention, age 0+ is the year of birth starting in January) is almost the highest since 1978, and the catch per unit of effort (CPUE) is the highest since 1978.
- The Northumberland Strait is a highly productive area as shown by several fact sheets (3.1.1, 3.2.3, 3.2.4, 3.2.12 - 3.2.14, 3.3.1, 3.4.7, and 3.5.1) and appendices (3.2.16, 3,3,3, 3.3.4, 3.4.8, and 3.5.4). Current gyres border each end of the Strait. High productivity is associated with these gyres because they concentrate the nutrients and the plankton, and attract species at higher trophic levels. The recurrent high catches of several species such as rock crab, lobster, herring, and mackerel also show that the Northumberland Strait is a highly productive area. Details about Pictou Harbour, Pictou Island and St. Georges Bay productivity can be gathered in other fact sheets (3.6.1 to 3.6.3). The high productivity of the coastal waters (21-35 m depth) between Pictou Harbour and St. Georges Bay is also reflected by the high concentration of scallop spat on collectors compared to surrounding area (3.4.7).

Vulnerability, threats and human pressure

- The fall-spawners stock has been at a high level in recent years. The 1995 and 1996 year-classes are considered to be large and will be the main component of the fishery for the next years.

- The gear used in the inshore gillnet herring fishery «*...appears to be quite efficient at capturing herring with limited impacts to other species. There is little information on by-catch from this fishery or incidental damage to other fisheries or marine species.*» [M8]
- In 1985, Environment Canada stated that «*Roe fisheries, particularly herring and capelin, are lucrative for producers but entail significant waste problem since there is no market for fish carcasses. Eighty percent of the landed weight of herring is thrown away when only the roe is used.*»[M9] This statement is no longer the example in the Southern Gulf herring fishery. Unused portions of the fish are processed at smokehouses and fish meal plants. [M10] However, the problem associated with fish meal plants is that they are considered «*to have a greater environmental impact, because of high BOD and potential toxicity as a consequence of lowered dissolved oxygen.*» [M11]
- Much of the habitat for fact sheet 3.2.3 is near shore on the eastern Northumberland Strait. Anthropogenic effects vary along this shore, from agricultural to cottage and leisure development. The effects of both these types of human development are difficult to quantify in the open ocean environment.
- Heavy industry in the area is located around Pictou Harbour (fact sheet 3.6.1).
- There are 16 ports and landing points in the statistical districts 11 and 12 (see map in appendix). Localised contamination can occur at these facilities in the form of oil waste from bilge water, accidental spills of gasoline and diesel fuel, and discarding of fish waste into the marine environment.

Socio-economic characteristics

- The herring fishery is of high economic importance in the Southern Gulf of St. Lawrence. Herring is the most important pelagic species by both weight and value landed in the Southern Gulf Region. The species is extensively fished in Division 4T (see map in appendix) overall (approximately 3500 inshore licenses and 6 seiner licenses). The fishery has been managed by Total Allowable Catch (TAC) since 1972. [M4]
- NAFO Division 4T landings for herring [M12]: (1975) 44,565 t, (1980) 35,180 t, (1985) 37,947t, (1990) 76,491t, (1995) 89,134t, and (1999) 71,886 t.
- NAFO Division 4T sub-divides into 7 Herring Fishing Areas (HFA) for Canadian fisheries management purposes (see map in appendix). The HFA of 16E, 16F, and 16G represent all of the study area for this report (The southern and western boundaries between P.E.I. and N.B. in area 16E represents the transitional boundary from the northeast N.B. report area [M13]). An inshore fleet pursues most of the effort directed at herring in these three areas.

- 2000 TAC for the Division 4T fall-spawning stock was set at 71,000 t with 54,714 t available to inshore fleet. The 2000 landings for the 4T fall-spawning stock were 59,086 t (inshore fleet: 50,398t or 85%). The inshore CPUE in 2000 was equal to 1999. It was also the highest for 1978-2000. [M]
- 16F is the area closely associated with fact sheet 3.2.3 fishing effort. Licenses for commercial herring fishing area 16F are 393 for N.S., and 16 for P.E.I.
- Herring landings [M14] occur predominately in statistical districts 11 and 12 (see map in appendix).

	10 year means (1990-99)		1999 landings	
	(metric tonnes)	($000)	(metric tonnes)	($000)
District 11,12	5,987	1,102	5,812	1,259
All districts Gulf N.S. and P.E.I.	19,445	3,710	27,863	6,481
Entire Gulf	61,428	10,560	64,828	14,374

- Average vessel effort reporting over 1 tonne landing (all Gulf N.S. districts) 1995-99 was 165. The most active year between 1995-99 (all Gulf N.S. districts) was 1996 (217 vessels).
- The fall herring fishery is predominately a roe fishery carried out by inshore gillnet vessels. The season generally takes place in August and September, when the fish spawn. Japan is the major market for herring roe. Price fluctuations in this market tend to correlate with fishing effort.
- There are other important commercial species, besides herring, that are landed in statistical districts 11 and 12 (1999 landed value over order $100,000):

Species	Value ($000)	Licenses (valid)	Season
Lobster (LFA 26A)	7,986	175	May 1- June 30
Scallop (SFA 24)	467	78	Sept.- Dec. (Varies)
Rock Crab (LFA 26 A)	398	30	Aug. 16- Nov. 13 (1999)
Mussels	100	21	Summer (except aquaculture)

Support, favourable and unfavourable factors

- Along the gulf coast of Nova Scotia, there is a model of DFO / industry co-operation. This co-management arrangement is a pilot project in herring

fishing area 16F. This arrangement produces funds that are used for research. The Gulf N.S. Herring Federation represents the industry.

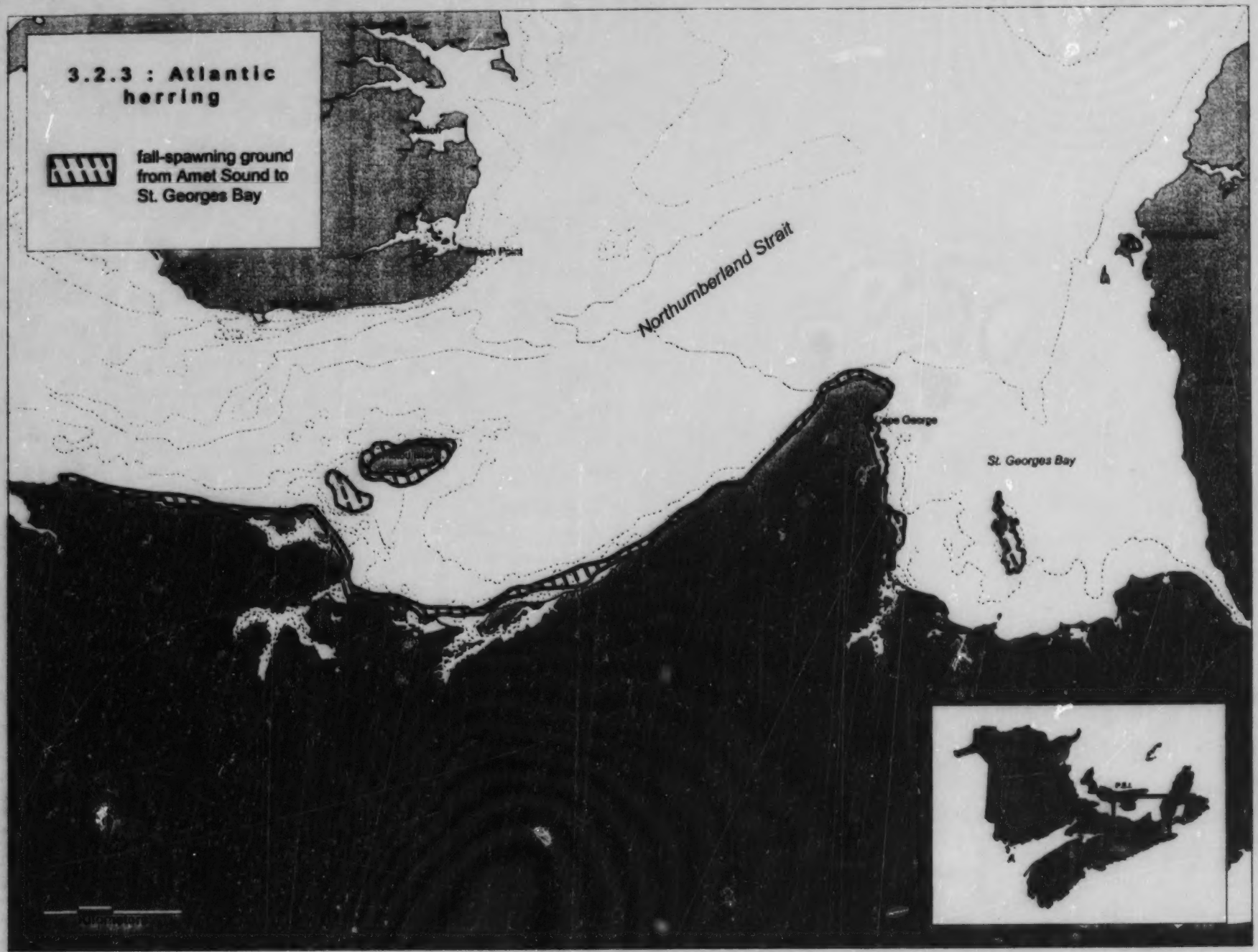
- There are several conservation areas along this portion of the coast. These include provincial park beaches and wildlife protection areas.
- The St. Georges Bay Ecosystem Project (GBEP) is a collaborative partnership between St. Francis Xavier University, marine harvester's organisations, Mi'kmaq Fish & Wildlife Commission (MFWC) and Fisheries & Oceans Canada. The intent of the project is to document and conduct applied analyses of the marine and human ecology of St. Georges Bay. This includes the area between Lismore, Pictou County and Pleasant Bay, Inverness County.
- There is currently a three year Integrated Fisheries Management Plan (IFMP) and an Annual Harvesting Plan in place to manage herring in this area.

Other associated significant habitats

- The Arnet Sound to St. Georges Bay area is a significant habitat included in fact sheets for: Irish moss (3.1.2), herring (3.2.5-juveniles), mackerel (3.2.10), white hake (3.2.12, 3.2.13), lobster (3.3.1), grey seal (3.5.1), Pictou Harbour (3.6.1), Pictou Island (3.6.2), and St. Georges Bay (3.6.3).
- Atlantic herring is associated with the following significant habitats: Fisherman's Bank and The Ridge (3.2.4), Northumberland Strait (3.2.5), St. Lawrence Bay (3.2. 6), Shediac Valley (3.2.7), Borden to North Cape (3.2.8), and North Cape (3.2.9), as well as Baie Verte to Amet Sound (see appendix).

References

H1: MacNeil, J.L. & Assoc., 1998
H2: C. LeBlanc, p.c. 2001
H3: P. Boyd, p. observ.
H4: DFO (Herring), 2001c
H5: LeBlanc et al., 2001
H6: D. Cairns, p.c., 2001
H7: Sinclair and Breen, 1998
H8: Davis et al., 2000, p.127
H9: Eaton et al., 1994, p.269.
H10: D. MacEwen, p.c., 2001
H11: Eaton et al., 1995, p.63
H12: NAFO, 2000
H13: Therrien et al., 2000
H14: DFO (Stats. Div.), data


3.2.3 : Atlantic herring
fall-spawning ground from Amet Sound to St. Georges Bay
Northumberland Strait
St. Georges Bay

3.2.4 Atlantic herring fall-spawning ground in Fisherman's Bank and The Ridge

Ecological Features

- Fall-spawning habitat for Atlantic herring is located at Fisherman's Bank and The Ridge [N1,N2,N5,N15-N17] (figure 3.2.4). Fisherman's Bank measures about 16.5 km^2 at a depth varying from 9 to 20 m. [N15] It is surrounded by deeper waters except on its northeast edge that elongates to form The Ridge, at a depth of 24-32 m. Fall-spawning grounds are usually found at depths between 3 and 12.5 fathoms (5-20 m) [N4], but they can reach as deep as 15.5 fathoms (25 m). [N2] The dominant substrate is cobble but sand and gravel are found at the edge of the bank. [N15]
- This site is one of the main fall-spawning areas near the Gulf coast of N.S. and around P.E.I. [N2,N5] Incidentally, this site was surveyed annually from 1985 to 1997 to determine herring spawning volume and progenitor biomass. [N15-N17] Other major spawning areas are located between Amet Sound and St. Georges Bay (fact sheet 3.2.3), and in North Cape (3.2.9). [N2]
- Herring fall-spawning times are stable and generally occur between mid-August and mid-September in this location. [N7,N17]
- The main fall-spawning stock for the entire Southern Gulf is located in Chaleur Bay. The stocks of Pictou, Fisherman's Bank and Escuminac-west of P.E.I. are almost equal at second rank. [N4,N5]
- The fall-spawners stock abundance remained high in recent years, and new high abundance year-classes (1995 and 1996) are now supporting the fishery. [N5] The estimated biomass of aged 4+ herring (by convention, age 0+ is the year of birth starting in January) is almost the highest since 1978, and the catch per unit of effort (CPUE) is the highest since 1978.
- Fisherman's Bank and The Ridge are known for their high productivity of a number of aquatic resources, including mackerel, witch flounder, cunner and several others who feed on herring eggs, and bluefin tuna who feed on these fish. [N2,N5] Concentrations of minke whale have also been observed feeding in the area. [N6]

Vulnerability, threats and human pressure

- The fall-spawners stock has been at a high level in recent years. The 1995 and 1996 year-classes are considered to be large and will be the main component of the fishery for the next years.
- Since 1999 there has been a buffer zone from East Point to Hillsborough Bay on the east coast of P.E.I., including Fisherman's Bank (see map in appendix). Fishers are not allowed to drag for scallops in this area.

- The gear used in the inshore gillnet herring fishery «*...appears to be quite efficient at capturing herring with limited impacts to other species. There is little information on by-catch from this fishery or incidental damage to other fisheries or marine species.*» [h8]
- In 1985, Environment Canada stated that «*Roe fisheries, particularly herring and capelin, are lucrative for producers but entail significant waste problem since there is no market for fish carcasses. Eighty percent of the landed weight of herring is thrown away when only the roe is used.*» [h9] This statement is no longer the example in the Southern Gulf herring fishery. Unused portions of the fish are processed at smokehouses and fish meal plants. [h10] However, the problem associated with fish meal plants is that they are considered «*to have a greater environmental impact, because of high BOD and potential toxicity as a consequence of lowered dissolved oxygen.*» [h11]
- Fisherman's Bank and the Ridge are specific ocean habitats. These two areas are offshore between P.E.I., northeast N.S., and Cape Breton. Marine environmental quality is considered to be good in this area.

Socio-economic characteristics

- The herring fishery is of high economic importance in the Southern Gulf of St. Lawrence. Herring is the most important pelagic species by both weight and value landed in the region. The species is extensively fished in Division 4T (see map in appendix) overall (approximately 3500 inshore licenses and 6 seiner licenses). The fishery has been managed by Total Allowable Catch (TAC) since 1972. [h4]
- NAFO Division 4T landings for herring [h12] : (1975) 44,565t, (1980) 35,180t, (1985) 37,947t, (1990) 76,491t, (1995) 89,134t, and (1999) 71,886t.
- NAFO Division 4T sub-divides into 7 Herring Fishing Areas (HFA) for Canadian fisheries management purposes (see map in appendix). The HFA of 16E, 16F, and 16G represent all of the study area for this report (The southern and western boundaries between P.E.I. and N.B. in area 16E represents the transitional boundary from the northeast N.B. report area [h13]). An inshore fleet pursues most of the effort directed at herring in these three areas.
- 2000 TAC for the Division 4T fall-spawning stock was set at 71,000 t with 54,714 t available to inshore fleet. The 2000 landings for the 4T fall-spawning stock were 59,086t (inshore fleet: 50,398 t or 85%). The inshore CPUE in 2000 was equal to 1999. It was also the highest for 1978-2000. [h4]
- HFA 16G is the area closely associated with fact sheet 3.2.4 fishing effort. Licenses for commercial HFA 16G are 378 for P.E.I, and 18 for N.S.
- Herring landings [h14] occur predominately in statistical districts 87 and 88 in P.E.I. (see map in appendix).

	10 year means (1990-99)		1999 landings	
	(metric tonnes)	($000)	(metric tonnes)	($000)
District 87,88	5,987	1,102	9,373	2,122
All districts Gulf N.S. and P E.I.	19,445	3,710	27,863	6,481
Entire Gulf	61,428	10,560	64,828	14,374

- The fall inshore herring fishery is predominately a roe fishery carried out by gillnet vessels. The season generally takes place in August and September, when the fish spawn. Japan is the major market for herring roe. Price fluctuations in this market tend to correlate with fishing effort.
- There are other important commercial species, besides herring, that are landed in statistical districts 87 and 88. These species are (1999 landed value order over $100,000):

Species	Value ($000)	Licenses (valid)	Season
Lobster (LFA 26A)	34,755	577	May 1- June 30
Mussel	6,695	32	Summer (wild) Year round (aquaculture)
Cod (3PN, 4R, 4T, 4S, 4VN)	764	416	Varies
Bluefin Tuna	686	219	Aug.- Nov.
Snow Crab	546	4	July- Sept.
Rock Crab (LFA 26A)	402	15	Aug. 9-Nov 9.(1999)
Softshell Clam	387	286	Summer
Silverside	359	27	
American Plaice (3PN, 4R, 4T, 4S, 4VN)	330	416	Varies
Mackerel	277	573	May – Aug.

Support, favourable and unfavourable factors

- Fisherman's Bank and the Ridge are known for their high productivity for several aquatic resources.
- The buffer zone restricting scallop drag fishing, which include Fisherman's Bank, was implemented in 1999 from a mutual agreement between fishers, which shows their concern about resource conservation and habitat protection.

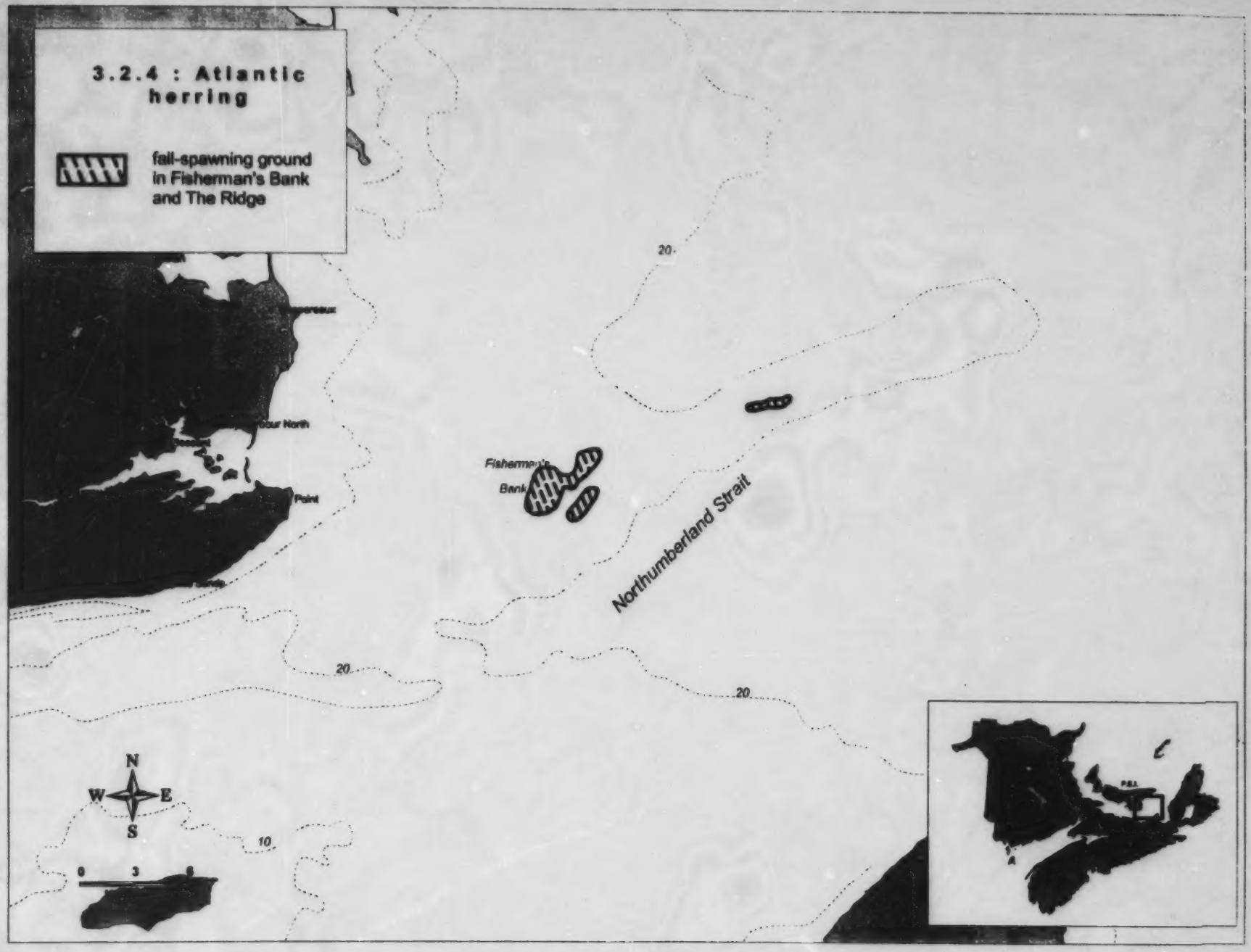
- There is potential for a co-operative plan between DFO and the industry, similar to the one in 16F.
- There is currently a three year Integrated Fisheries Management Plan (IFMP) and an Annual Harvesting Plan.

Other associated significant habitats

- The Fisherman's Bank and The Ridge area are significant habitats included in fact sheets for: herring (3.2.5-juveniles), bluefin tuna (3.2.14), grey seal (3.5.1), and Fisherman's Bank (3.6.6).
- Atlantic herring is associated with the following significant habitats: Amet Sound to St. Georges (3.2.3), Northumberland Strait (3.2.5), St. Lawrence Bay (3.2.6), Shediac Valley (3.2.7), Borden to North Cape (3.2.8), and North Cape (3.2.9), as well as Baie Verte to Amet Sound (see appendix).

References

H1: MacNeil, J.L. & Assoc., 1998
H2: C. LeBlanc, p.c. 2001
H4: DFO (Herring), 2001c
H5: LeBlanc et al., 2001
H6: D. Cairns, p.c., 2001
H7: Sinclair and Breen, 1998
H8: Davis et al., 2000, p.127
H9: Eaton et al., 1994, p.269.
H10: D. MacEwen, p.c., 2001
H11: Eaton et al., 1994, p.63
H12: NAFO, 2000
H13: Therrien et al., 2000
H14: DFO (Stats. Div.), data
H15: Cairns et al., 1996
H16: Cairns, 1995
H17: Cairns et al., 1993


3.2.4 : Atlantic herring
fall-spawning ground in Fisherman's Bank and The Ridge
20
20
20
10
Northumberland Strait
Fisherman's Bank
Point
N
W
E
S
0
3
6

3.2.5 Atlantic herring nursery in Northumberland Strait

Ecological Features

- There are high concentrations of juvenile Atlantic herring in Northumberland Strait up to the tip of P.E.I. (figure 3.2.5). [h2] The boundaries of this significant habitat are approximate and depend on sampled areas (e.g. shallower waters were usually not sampled). They are generally found at depths less than 40 m. [h2]
- This is the third largest concentration of juvenile herrings, the largest being found in Chaleur Bay. [h18-h20] There is also a second nursery habitat located in Shediac Valley [h18,h20,h21] (fact sheet 3.2.7).
- The juveniles of 0+ of age (by convention, age 0+ is the year of birth starting in January) are usually found at depths less than 15.5 fathoms (25 m) [h18,h21], while 1+ and 2+ are usually between 12.5 and 31 fathoms (20 and 50 m) [h18,h21] and 3+ are with the adults at depths greater than 31 fathoms (50 m). [h18,h20]
- The Northumberland Strait is a highly productive area as shown by several fact sheets (3.1.1, 3.2.3, 3.2.4, 3.2.12 - 3.2.14, 3.3.1, 3.4.7, and 3.5.1) and appendices (3.2.16, 3,3,3, 3.3.4, 3.4.8, and 3.5.4). Current gyres border each end of the Strait. High productivity is associated with these gyres because they concentrate the nutrients and the plankton, and attract species at higher trophic levels. The recurrent high catches of several species such as rock crab, lobster, herring, and mackerel also show that the Northumberland Strait is a highly productive area. Details about Pictou Harbour, Pictou Island and St. Georges Bay productivity can be gathered in other fact sheets (3.6.1 to 3.6.3). The high productivity of the coastal waters (21-35 m depth) between Pictou Harbour and St. Georges Bay is also reflected by the high concentration of scallop spat on collectors compared to surrounding area (3.4.7).

Vulnerability, threats and human pressure

- The fall-spawners stock has been at a high level in recent years. The 1995 and 1996 year-classes are considered to be large and will be the main component of the fishery for the next years. The spring-spawner stock abundance has been decreasing since 1995, and no new high abundance year-class has been detected since the 1991 year-class. [h5]
- There is trawling (groundfish) and dragging (scallops) in this sector. [h22] Both could damage the herring resource, but dragging is thought to have greater adverse effects.

- Since 1999 there has been a buffer zone from East Point to Hillsborough Bay on the east coast of P.E.I., including Fisherman's Bank (see map in appendix). Fishers are not allowed to drag for scallops in this area.
- The gear used in the inshore gillnet herring fishery «*...appears to be quite efficient at capturing herring with limited impacts to other species. There is little information on by-catch from this fishery or incidental damage to other fisheries or marine species.*» [m8]
- Some of the habitat for fact sheet 3.2.5 is near shore. Anthropogenic effects vary along these shores, from agricultural to cottage and leisure development. The effects of these various types of human development are difficult to quantify in the open ocean environment.
- Heavy industry in the area is located around Pictou Harbour (fact sheet 3.6.1).
- There are 16 ports and landing points in statistical district 11 and 12 (see map in appendix). Localised contamination can occur at these facilities in the form of oil waste from bilge water, accidental spills of gasoline and diesel fuel, and discarding of fish waste into the marine environment.

Socio-economic characteristics

- The herring fishery is of high economic importance in the Southern Gulf of St. Lawrence. Herring is the most important pelagic species by both weight and value landed in the Southern Gulf Region. The species is extensively fished in Division 4T (see map in appendix) overall (approximately 3500 inshore licenses and 6 seiner licenses). The fishery has been managed by Total Allowable Catch (TAC) since 1972. [m9]
- NAFO Division 4T landings for herring [m12]: (1975) 44,565t, (1980) 35,180t, (1985) 37,947t, (1990) 76,491t, (1995) 89,134t, and (1999) 71,886t.
- NAFO Division 4T sub-divides into 7 Herring Fishing Areas (HFA) for Canadian fisheries management purposes (see map in appendix). The HFA of 16E, 16F, and 16G represent all of the study area for this report (The southern and western boundaries between P.E.I. and N.B. in area 16E represent the transitional boundary from the northeast N.B. report area [m13]). An inshore fleet pursues most of the effort directed at herring in these three areas.
- Licenses for commercial herring fishing area 16F are 16 (P.E.I.) and 393 (N.S.), in HFA 16G they are 378 (P.E.I) and 18 (N.S.), and in HFA 16E/C they are 469 (P.E.I.) and 617 (N.B.).
- Landings [m14] by statistical districts (see map in appendix) are:

	10 year means (1990-99)		1999 landings	
	(metric tonnes)	($000)	(metric tonnes)	($000)
District 11 and 12	5,500	1,098	5,812	1,259
District 87 and 88	5,987	1,102	9,373	2,122
District 82 and 83	2,526	479	3,022	987
All districts Gulf N.S. and P.E.I.	19,445	3,710	27,863	6,481
Entire Gulf	61,428	10,560	64,828	14,374

- Average vessel effort reporting over 1 tonne landing (all Gulf N.S. districts) 1995-99 was 165, average vessel effort over the same period for P.E.I. was 110. The most active year between 1995-99 (all Gulf N.S. districts) was 1996 (217 vessels). The most active year between 1995-99 (districts 87 and 88) was 1997 and 1999 (124 vessels).
- The fall herring fishery is predominately a roe fishery carried out by inshore gillnet vessels. Japan is the major market for herring roe.
- There are other important commercial species, besides herring, that are landed in statistical districts 11 12, 87 and 88. These species are (1999 landed value order over $100,000):

Species	Value ($000)	Licenses (valid)	Season
Lobster (LFA 26A)	42,741	752	May 1- June 30
Mussel	6,795	53	Summer (wild) Year round (aquaculture)
Cod (3PN, 4R, 4T, 4S, 4VN)	764	416	Varies
Bluefin Tuna	686	219	Aug.- Nov.
Snow Crab	546	4	July- Sept.
Rock Crab (LFA 26A)	800	45	Aug. 9-Nov 13.(1999)
Scallop (SFA 24)	467	78	Sept.- Dec. (Varies)
Softshell Clam	387	286	Summer
Silverside	359	27	
American Plaice (3PN, 4R, 4T, 4S, 4VN)	330	416	Varies
Mackerel	277	573	May – Aug.

Support, favourable and unfavourable factors

- Along the gulf coast of Nova Scotia, there is a model of DFO / industry co-operation. This co-management arrangement is a pilot project in herring fishing area 16F. This arrangement produces funds that are used for research. The Gulf N.S. Herring Federation represents industry.
- There are several conservation areas along this portion of the coast. These include provincial park beaches and wildlife protection areas.
- The buffer zone restricting scallop drag fishing was implemented in 1999 from a mutual agreement between fishers, which shows their concern about resource conservation and habitat protection.
- This site covers an area with multiple interests.
- There is currently a three year Integrated Fisheries Management Plan (IFMP) and an Annual Harvesting Plan.

Other associated significant habitats

- Northumberland Strait is a significant habitat included in fact sheets or appendices for: Irish moss (3.1.2), herring (3.2.3, 3.2.4-spawning grounds), mackerel (3.2.10), white hake (3.2.12, 3.2.13), bluefin tuna (3.2.14), lobster (3.3.1), scallop (3.4.7), grey seal (3.5.1), Pictou Island (3.6.2), St. Georges Bay (3.6.3), and Fisherman's Bank (3.6.6), as well as herring, rock crab and grey seal (in appendix).
- Atlantic herring is associated with the following significant habitats: Amet Sound to St. Georges Bay (3.2.3), Fisherman's Bank and The Ridge (3.2.4), St. Lawrence Bay (3.2.6), Shediac Valley (3.2.7), Borden to North Cape (3.2.8), and North Cape (3.2.9), as well as Baie Verte to Amet Sound (see appendix).

References

H2: C. LeBlanc, p.c. 2001

H5: LeBlanc et al., 2001

H8: Davis et al., 2000, p.127

H12: NAFO, 2000

H13: Therrien et al., 2000

H14: DFO (Stats. Div.), data

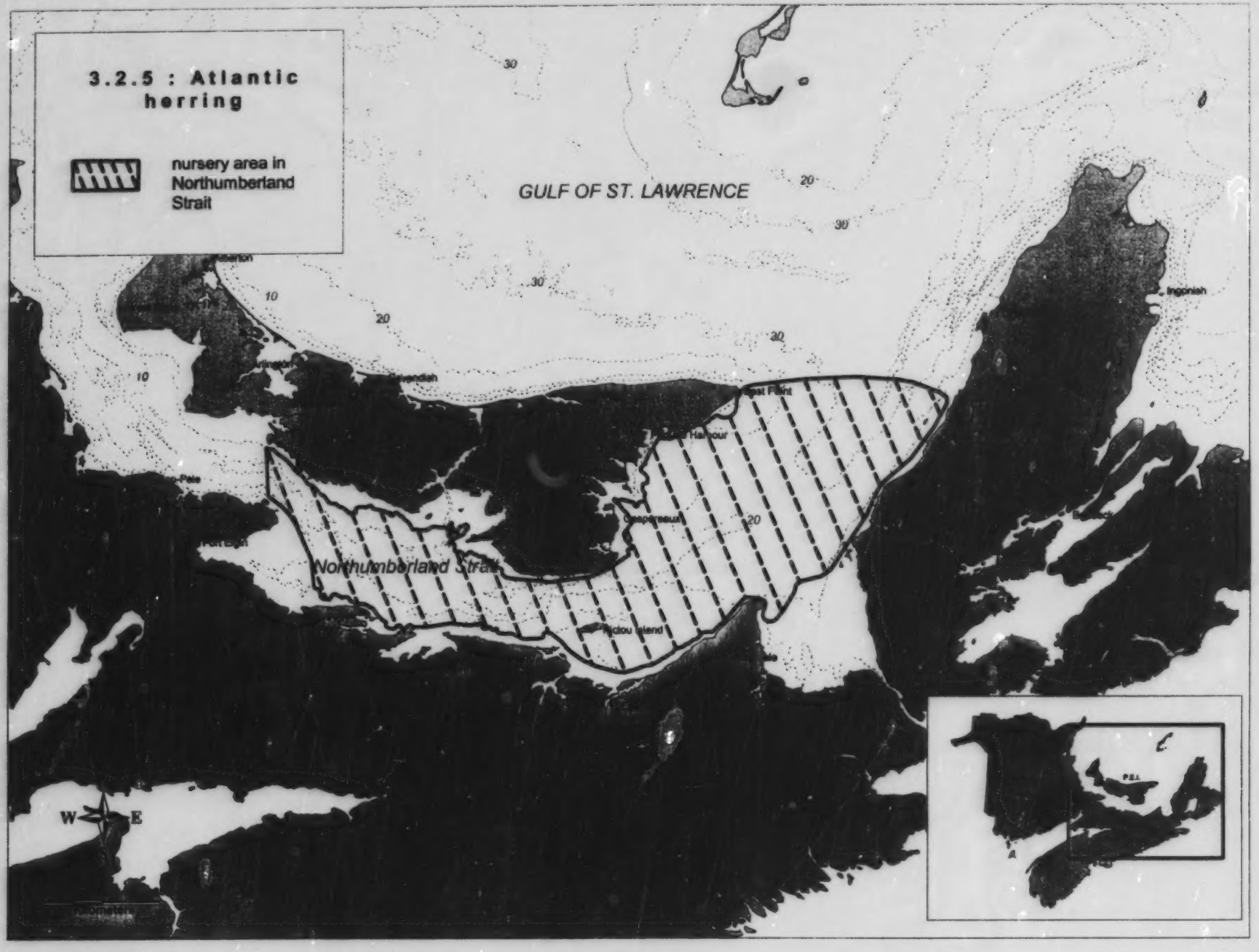
H18: C. LeBlanc, p.c., 1999 in Therrien et al, 2000

H19: Dupuis et al., 1997

H20: LeBlanc et al., 1998

H21: LeBlanc et al., 1997

H22: DFO Fishery officers p.c. 1999 in Therrien et al., 2000


3.2.5 : Atlantic herring
nursery area in Northumberland Strait
GULF OF ST. LAWRENCE
Northumberland Strait
30
20
10
W
E

3.2.6 Atlantic herring spring-spawning ground in St. Lawrence Bay

Ecological Features

- Spring-spawning habitat for Atlantic herring is located in St. Lawrence Bay [h1,h2,h23] (figure 3.2.6). Spring-spawning grounds are usually found at depths of less than 3 fathoms (5 m). [h4]
- The most important spring-spawning ground in the Southern Gulf is located near the Magdalen Islands, western Northumberland Strait and Escuminac (N.B.). [h2] However, the St. Lawrence Bay spring-spawning ground is the major known area on the western shore of Cape Breton. [h23] Other sites are likely to be found in shallow waters where fine substrate (sand, gravel) is present.
- Spring-spawning occurs mostly in May but it can extend until June.
- A decrease has been observed in the spring-spawners stock abundance since 1995. This is associated with a decline in the 4+ biomass (by convention, age 0+ is the year of birth starting in January). No strong year-class has been detected since 1991 and the CPUE in 2000 was the lowest since 1990. [h5]

Vulnerability, threats and human pressure

- The spring-spawners stock abundance has been decreasing since 1995, and no new high abundance year-class has been detected since the 1991 year-class. [h5]
- The gear used in the inshore gillnet herring fishery «*...appears to be quite efficient at capturing herring with limited impacts to other species. There is little information on by-catch from this fishery or incidental damage to other fisheries or marine species.*» [h6]
- The land-based human presence that lays adjacent to the inshore area of Bay St. Lawrence has low population and minimal agricultural development. Due to this the anthropogenic factors are limited in comparison to other study areas of this report.

Socio-economic characteristics

- The herring fishery is of high economic importance in the Southern Gulf of St. Lawrence. Herring is the most important pelagic species by both weight and value landed in the Southern Gulf Region. The species is extensively fished in NAFO Division 4T (see map in appendix) overall (approximately 3500 inshore licenses and 6 seiner licenses). The fishery has been managed by Total Allowable Catch (TAC) since 1972. [h4]

- NAFO Division 4T landings for herring [h12] : (1975) 44,565t, (1980) 35,180t, (1985) 37,947t, (1990) 76,491t, (1995) 89,134t, and (1999) 71,886t.
- NAFO Division 4T sub-divides into 7 Herring Fishing Areas (HFA) for Canadian fisheries management purposes (see map in appendix). The HFA of 16E, 16F, and 16G represent all of the study area for this report (The southern and western boundaries between P.E.I. and N.B. in area 16E represent the transitional boundary from the northeast N.B. report area [h13]). An inshore fleet pursues most of the effort directed at herring in these three areas.
- 2000 TAC for the Division 4T spring-spawning stock was set at 16,500 t with 12,708 t available to inshore fleet. The 2000 landings for the 4T fall-spawning stock were 16,730t (inshore fleet: 16,181t or 96%). The 2000 CPUE was the lowest since 1990, except for the 1999 year which is being underestimated. [h5]
- HFA 16G is the area associated with fact sheet 3.2.6 fishing effort. 19 licenses are registered for HFA 16G in Cape Breton statistical district 2 (see map in appendix).
- Herring landings [h14] occur predominately in statistical district 2 (N.S.).

	10 year means (1990-99)		1999 landings	
	(metric tonnes)	($000)	(metric tonnes)	($000)
District 2	913	143	3,913	730
All districts Gulf N.S. and P.E.I.	19,445	3,710	27,863	6,481
Entire Gulf	61,428	10,560	64,828	14,374

- Landings in district 2 steadily grew during the 1990's. The five-year mean landings (1990-94) was 30t. The five-year mean landings (1995-99) was 1796t. Landings in 1999 were the highest over the ten-year span (1990-99).
- The spring inshore herring fishery is predominately a food and bait fishery. Southern N.B. is the major market for bloaters (smoked herring). The lobster fishery runs concurrent to the spring spawning of herring. Herring is a useful bait fish in the lobster fishery, thus, many lobster fishers have bait licenses for herring; there are 142 bait licenses in district 2.
- There are other important commercial species, besides herring, that are landed in statistical district 2. These species are (1999 landed value order over $100,000):

Species	Value ($000)	Licenses (valid)	Season
Snow Crab (Area 18 & 19)	10,868	75	July- Sept.
Lobster (LFA 26B)	5,208	117	May 1- June 30
Cod (3PN, 4R, 4T, 4S, 4VN)	998	84 (unspecified groundfish)	Varies
Witch Flounder (3PN, 4R, 4T, 4S, 4VN)	443	84 (unspecified groundfish)	Varies
American Plaice (3PN, 4R, 4T, 4S, 4VN)	275	84 (unspecified groundfish)	Varies
Gaspereau	169	26	May- June
Redfish (3PN, 4R, 4T, 4S, 4VN)	111	84 (unspecified groundfish)	Varies

Support, favourable and unfavourable factors

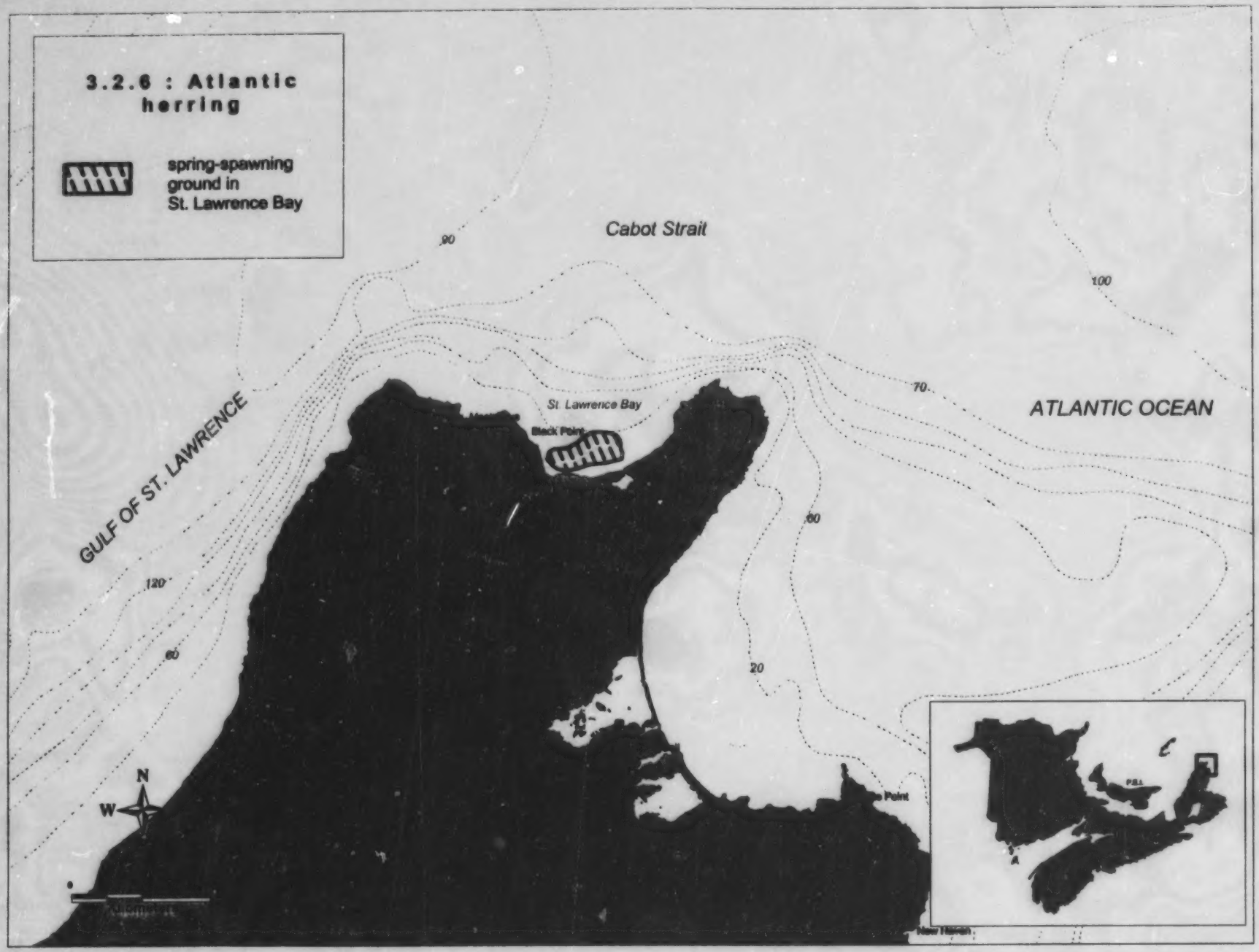
- Adjacent to Cape Breton Highland National Park.
- Whale watching industry active in this area.
- Harvesting effort mainly by larger transient seiner fleet.
- There is potential for a co-operative plan between DFO and the industry, similar to the one in 16F.
- There is currently a three year Integrated Fisheries Management Plan (IFMP) and an Annual Harvesting Plan for the stock in this area.

Other associated significant habitats

- The St. Lawrence Bay area is a significant habitat included in fact sheet for: capelin (3.2.1).
- Atlantic herring is associated with the following significant habitats: Arnet Sound to St. Georges Bay (3.2.3), Fisherman's Bank and The Ridge (3.2.4), Northumberland Strait (3.2.5), Shediac Valley (3.2.7), Borden to North Cape (3.2.8), and North Cape (3.2.9), as well as Baie Verte to Arnet Sound (see appendix).

References

H1: MacNeil, J.L. & Assoc., 1998
H2: C. LeBlanc, p.c. 2001
H4: DFO (Herring), 2001c
H5: LeBlanc et al., 2001
H8: Davis et al., 2000, p.127
H12: NAFO, 2000
H13: Therrien et al., 2000
H14: DFO (Stats. Div.), data
H23: G. Aucoin, p.c. 2001


3.2.6 : Atlantic herring
spring-spawning ground in St. Lawrence Bay
Cabot Strait
90
100
70
ATLANTIC OCEAN
St. Lawrence Bay
Black Point
GULF OF ST. LAWRENCE
120
60
60
20
N
W
Point
PEI

3.2.7 Atlantic herring nursery and overwintering area in Shediac Valley

Ecological Features

- There are high concentrations of juvenile Atlantic herring in Shediac Valley (figure 3.2.7). The boundaries of this significant habitat are approximate, depending on sampled areas (e.g. shallower waters were usually not sampled), and they are generally found at depths of less than 40 m. [h2]
- This is the second largest concentration of juveniles [h18,h20,h21], the largest concentration being found in Chaleur Bay. [h18-h20] There is also a third site located in Northumberland Strait (fact sheet 3.2.5).
- They are mostly spring-spawned juveniles [h20]; those of 0+ of age (by convention, age 0+ is the year of birth starting in January) are usually found at depths less than 15.5 fathoms (25 m) [h18,h21], while 1+ and 2+ are usually between 12.5 and 31 fathoms (20 and 50 m) [h18,h21] and 3+ are with the adults at depths greater than 31 fathoms (50 m). [h18,h20]
- Juvenile concentrations are higher in the southern part of the valley [h21], near a current gyre at the entrance to the Northumberland Strait. It is associated with a high productivity because it concentrates the nutrients and the plankton, and attracts species at higher trophic levels.
- Shediac Valley is a highly productive area, containing notably the main nursery area for juvenile Atlantic cod (fact sheet 3.2.2). [h25]

Vulnerability, threats and human pressure

- The fall-spawners stock has been at a high level in recent years. The 1995 and 1996 year-classes are considered to be large and will be the main component of the fishery for the next years. The spring-spawners stock abundance has been decreasing since 1995, and no new high abundance year-class has been detected since the 1991 year-class. [h5]
- There is trawling (groundfish) and dragging (scallops) in this sector. [h22] Both could damage the herring resource, but dragging is thought to have greater adverse effects.
- The gear used in the inshore gillnet herring fishery «*...appears to be quite efficient at capturing herring with limited impacts to other species. There is little information on by-catch from this fishery or incidental damage to other fisheries or marine species.*» [h5]
- The land-based human presence that lays adjacent to the inshore area of this fact sheet has low population and minimal agricultural development. But the area receives water from the Miramichi basin that is polluted. The major sources of pollution on the Miramichi are mining activities (Heath Steele mine, located on a Northwest Miramichi tributary), pulp and paper mills

(REPAP, Eagle, Acadia, Nelson Forest products) and wastewater from towns and villages. The problems associated with these pollutants are undetermined, but the suspected limiting factors include suspended sediments, sedimentation on the spawning ground and chemical pollution (metal, solvents, organic contaminants, etc.). Wastewater could have an impact on dissolved oxygen (increase in BOD, or biochemical oxygen demand). REPAP has recently improved its water treatment facility and the dioxins and furans effluents have met the guidelines since 1995. Suspended sediment criteria was met in 1997. [h13]

Socio-economic characteristics

- The herring fishery is of high economic importance in the Southern Gulf of St. Lawrence. Herring is the most important pelagic species by both weight and value landed in the Southern Gulf Region. The species is extensively fished in Division 4T (see map in appendix) overall (approximately 3500 inshore licenses and 6 seiner licenses). The fishery has been managed by Total Allowable Catch (TAC) since 1972. [h4]
- NAFO Division 4T landings for herring [h12]: (1975) 44,565t, (1980) 35,180t, (1985) 37,947t, (1990) 76,491t, (1995) 89,134t, and (1999) 71,886t.
- NAFO Division 4T sub-divides into 7 Herring Fishing Areas (HFA) for Canadian fisheries management purposes (see map in appendix). The HFA of 16E, 16F, and 16G represent all of the study area for this report (The southern and western boundaries between P.E.I. and N.B. in area 16E represent the transitional boundary from the northeast N.B. report area [h15]). An inshore fleet pursues most of the effort directed at herring in these three areas.
- HFA 16E is the area associated with fact sheet 3.2.7 fishing effort. No detailed information is available on the effort. Licenses for commercial HFA 16E/C are 469 in P.E.I., and 617 for N.B.
- Herring landings [h14] occur predominately in statistical districts 82 and 92 (P.E.I.), and district 73 (N.B.) (see map in appendix).

	10 year means (1990-99)		1999 landings	
	(metric tonnes)	($000)	(metric tonnes)	($000)
District 82	1,611	301	1,799	585
District 92	3,668	711	5,069	1,175
District 73 (N.B.)	6,028	958	5,605	1,317
All districts Gulf N.S. and P.E.I.	19,445	3,710	27,863	6,481
Entire Gulf	61,428	10,560	64,828	14,374

- Landings in districts 82 and 92 have been stable and trending upward in the 1990's. The five-year (1990-94) mean landings for district 82 was 925t, and 2,377t for district 92. The five-year (1995-99) mean landings for district 82 was 2,297t, and 4,959t for district 92.
- Landings in district 73 are stable but have declined somewhat over the 1990-99 period. Five-year (1990-94) mean for district 73 was 6,448t, and 5,608t for 1995-99.
- The fall herring fishery is predominately a roe fishery carried out by inshore gillnet vessels. Japan is the major market for roe herring. Price fluctuations in this market tend to correlate with fishing effort.
- There are other important commercial species, besides herring, that are landed in statistical districts 82 and 92. These species are (1999 landed value order over $100,000):

Species	Value ($000)	Licenses (valid)	Season
Lobster (LFA 24)	16,811	272	May 1- June 30
Lobster (LFA 25)	14,335	153	Mid Aug.-Mid Oct.
Snow Crab (Area 12)	3,495	16	July- Sept.
Mackerel	1,405	443	May-Sept.
Cod (3PN, 4R, 4T, 4S, 4VN)	730	198 (unspecified groundfish)	Varies
Bluefin Tuna	337	100	July-Nov.
Irish Moss	1,148	261	Summer
Scallop (SFA 22)	385	44	May -June
Rock Crab	340	4	May- June
Oyster	263	200	Sept. 15-Nov. 15
Softshell Clam	254	161	Summer

Support, favourable and unfavourable factors

- This site covers an area with multiple jurisdictional interests.
- There is potential for a co-operative plan between DFO and the industry, similar to the one in 16F.
- There is currently a three year Integrated Fisheries Management Plan (IFMP) and an Annual Harvesting Plan.

Other associated significant habitats

- Shediac Valley is a significant habitat included in fact sheets or appendices for: cod (3.2.2), herring (3.2.8-spawning ground), mackerel (3.2.10), bluefin

tuna (3.2.14), scallop (3.4.7), harp seal (3.5.3), as well as rock crab and grey seal (in appendix). Several other habitats are also mentioned in the northeast N.B. report. [H13]

- Atlantic herring is associated with the following significant habitats: Amet Sound to St. Georges Bay (3.2.3), Fisherman's Bank and The Ridge (3.2.4), Northumberland Strait (3.2.5), St. Lawrence Bay (3.2.6), Borden to North Cape (3.2.8), and North Cape (3.2.9), as well as Baie Verte to Amet Sound (see appendix).

References

H2: C. LeBlanc, p.c. 2001

H4: DFO (Herring), 2001c

H5: LeBlanc et al., 2001

H8: Davis et al., 2000, p.127

H12: NAFO, 2000

H13: Therrien et al., 2000

H14: DFO (Stats. Div.), data

H18: C. LeBlanc, p.c., 1999 in Therrien et al, 2000

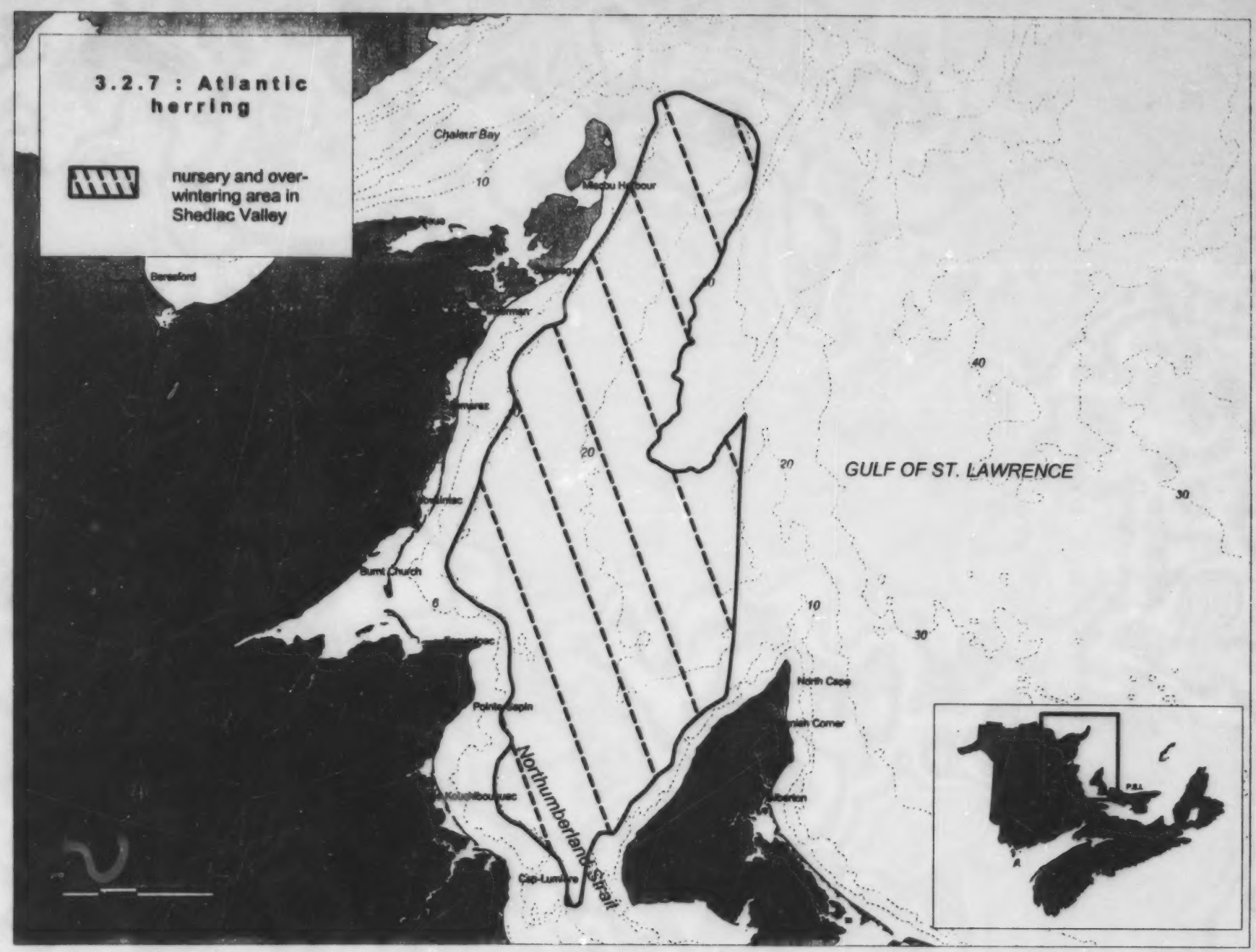
H19: Dupuis et al., 1997

H20: LeBlanc et al., 1998

H21: LeBlanc et al., 1997

H22: DFO Fishery officers p.c. 1999 in Therrien et al., 2000

H25: G. Chouinard, p.c., 1999 in Therrien et al., 2000


3.2.7 : Atlantic herring
nursery and over-wintering area in Shediac Valley
Chaleur Bay
Miscou Harbour
Bathurst
Caraquet
Shippagan
Tracadie
Shediac
Buctouche
Burnt Church
Escuminac
Pointe-Sapin
Kouchibouguac
Cap-Lumière
Northumberland Strait
GULF OF ST. LAWRENCE
North Cape
Miscou
PEI
10
20
30
40

3.2.8 Atlantic herring spring-spawning ground from Port Borden to North Cape

Ecological Features

- Spring-spawning habitat for Atlantic herring is located from Port Borden to North Cape [h1,h2,h24] (figure 3.2.8). Spring-spawning grounds are usually found at depths of less than 6 fathoms (10 m). [h4]
- The most important spring-spawning ground in the Southern Gulf is located near the Magdalen Islands, western Northumberland Strait and Escuminac (N.B.). [h2] However, the spring-spawning ground areas along the coast from Port Borden to North Cape are the major known areas around P.E.I. There are other areas along the coast of P.E.I. where spring-spawners would be located but these areas are less known.
- Spring-spawning occurs mostly in May but it can extend until June.
- A decrease has been observed in the spring-spawners stock abundance since 1995. This is associated with a decline in the 4+ biomass (by convention, age 0+ is the year of birth starting in January). No strong year-class has been detected since 1991 and the CPUE in 2000 was the lowest since 1990. [h5]
- Spring-spawning stock near Escuminac, the largest in the Southern Gulf during most of the 80's and 90's, has been noted to decline in the last two years. [h5] However, the P.E.I. stock has been improving in recent years but only in Egmont Bay.
- Part of this site is also used by fall-spawners (fact sheet 3.2.9).

Vulnerability, threats and human pressure

- The spring-spawners stock abundance has been decreasing since 1995, and no new high abundance year-class has been detected since the 1991 year-class. [h5]
- The gear used in the inshore gillnet herring fishery «*...appears to be quite efficient at capturing herring with limited impacts to other species. There is little information on by-catch from this fishery or incidental damage to other fisheries or marine species.*» [h8]
- Much of the habitat for section 3.2.8 is near shore on the western Northumberland Strait. Anthropogenic effects vary along this shore, from agricultural to cottage/leisure development. The effects of both these types of human development are difficult to quantify in the open ocean environment.
- There are 84 ports and landing points in the statistical districts 82 and 83 (see map in appendix). Localised contamination can occur at these facilities

in the form of oil waste from bilge water, accidental spills of gasoline and diesel fuel, and discarding of fish waste into the marine environment.

Socio-economic characteristics

- The herring fishery is of high economic importance in the Southern Gulf of St. Lawrence. Herring is the most important pelagic species by both weight and value landed in the Southern Gulf Region. The species is extensively fished in NAFO Division 4T (see map in appendix) overall (approximately 3500 inshore licenses and 6 seiner licenses). The fishery has been managed by Total Allowable Catch (TAC) since 1972. [h4]
- NAFO Division 4T landings for herring [h12] : (1975) 44,565t, (1980) 35,180t, (1985) 37,947t, (1990) 76,491t, (1995) 89,134t, and (1999) 71,886t.
- NAFO Division 4T sub-divides into 7 Herring Fishing Areas (HFA) for Canadian fisheries management purposes (see map in appendix). The HFA of 16E, 16F, and 16G represent all of the study area for this report (The southern and western boundaries between P.E.I. and N.B. in area 16E represent the transitional boundary from the northeast N.B. report area [h13]). An inshore fleet pursues most of the effort directed at herring in these three areas.
- 2000 TAC for the Division 4T spring-spawning stock was set at 16,500 t with 12,708 t available to inshore fleet. The 2000 landings for the 4T fall-spawning stock were 16,730t (inshore fleet: 16,181t or 96%). The 2000 CPUE was the lowest since 1990, except for the 1999 year which is being underestimated. [h5]
- HFA 16E is the area associated with section 3.2.8 fishing effort. No detailed information is available on the effort. Licenses for commercial HFA 16E/C are 469 for P.E.I., and 617 for N.B.
- Herring landings [h14] occur predominately in statistical districts 82 and 83 (P.E.I.).

	10 year means (1990-99)		1999 landings	
	(metric tonnes)	($000)	(metric tonnes)	($000)
District 82,83	2,526	479	3,022	987
All districts Gulf N.S. and P.E.I.	19,445	3,710	27,863	6,481
Entire Gulf	61,428	10,560	64,828	14,374

- Landings in district 82 and 83 have grown in the 1990's. The five-year mean landings (1990-94) was 1,654t. The five-year mean landings (1995-99) was 3,399t. Landings in 1996 were the highest over the ten-year span (1990-99).

- The spring inshore herring fishery is predominately a food and bait fishery. Southern N.B. is the major market for bloaters (smoked herring).
- There are other important commercial species, besides herring, that are landed in statistical districts 82 and 83. These species are (1999 landed value order over $100,000):

Species	Value ($000)	Licenses (valid)	Season
Lobster (LFA 25)	16,643	213	Mid Aug.-Mid Oct.
Oyster	3,390	792	Apr. 15- July 15 (relay) Sept. 15- Nov. 15 (open)
Quahog	578	511	Summer
Softshell Clam	158	512	Summer
Irish Moss	855	149	Summer
Mackerel	548	158	May – Sept.
Smelts	100	28	Sept.- March
Scallop (SFA 22)	385	44	May -June
Rock Crab	486	6	May- June

Support, favourable and unfavourable factors

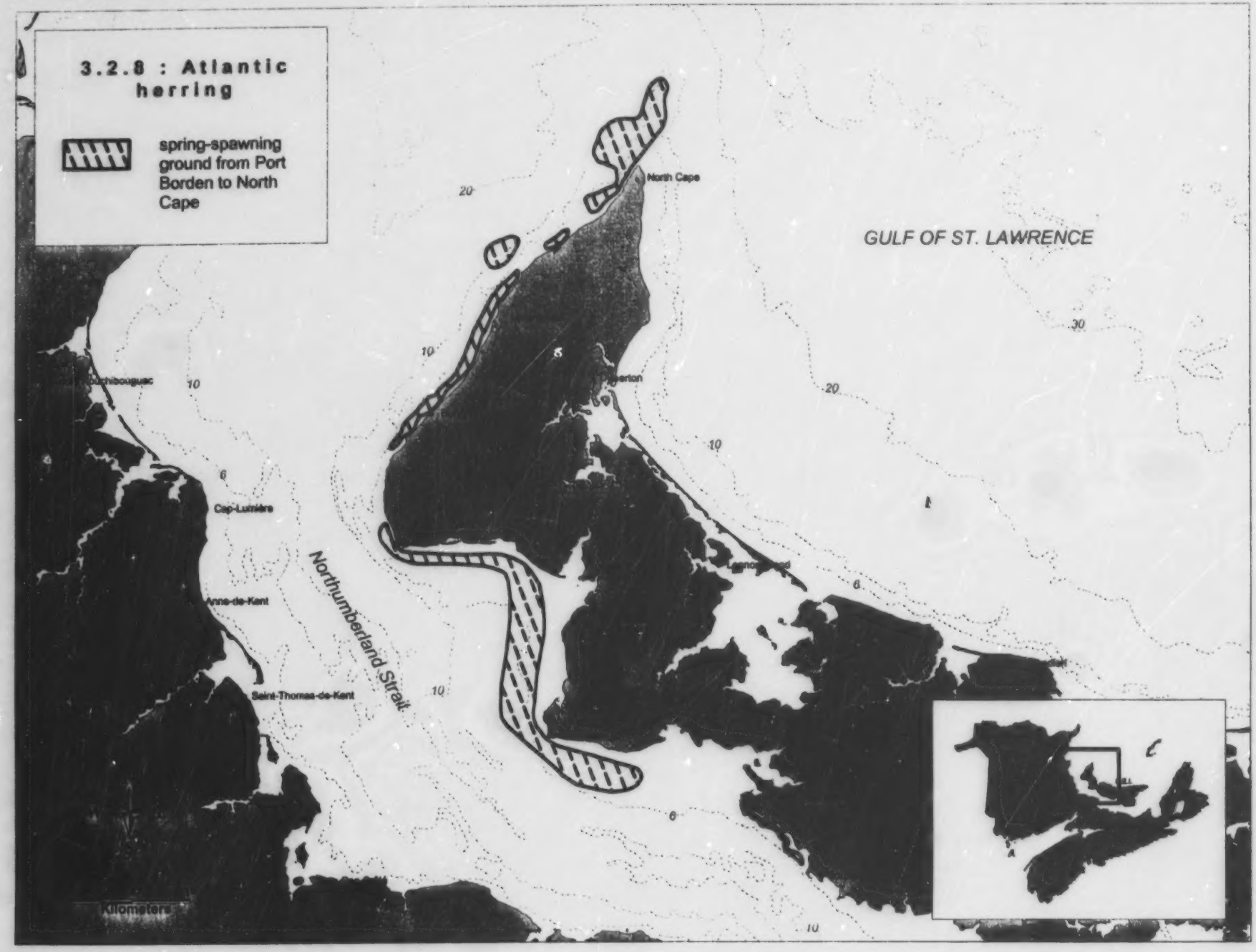
- There was a conflict between scallop and herring fisheries in 2001 as the herring season extended longer because the quota was caught slower than in recent years.
- There is currently a three year Integrated Fisheries Management Plan (IFMP) and an Annual Harvesting Plan for the stock in that area.
- There is potential for a co-operative plan between DFO and the industry, similar to the one in 16F.

Other associated significant habitats

- The Port Borden to North Cape area is a significant habitat included in fact sheets or appendices for: Irish moss (3.1.2), cod (3.2.2), herring (3.2.7-juveniles; 3.2.9 fall-spawning), bluefin tuna (3.2.14), lobster (3.3.1), and harp seal (3.5.3), as well as rock crab, surf clam, and grey seal (in appendix).
- Atlantic herring is associated with the following significant habitats: Amet Sound to St. Georges Bay (3.2.3), Fisherman's Bank and The Ridge (3.2.4), Northumberland Strait (3.2.5), St. Lawrence Bay (3.2.6), Shediac Valley (3.2.7), and North Cape (3.2.9), as well as Baie Verte to Amet Sound (see appendix).

References

H1: MacNeil, J.L. & Assoc., 1998
H2: C. LeBlanc, p.c. 2001
H4: DFO (Herring), 2001c
H5: LeBlanc et al., 2001
H8: Davis et al., 2000, p.127
H12: NAFO, 2000
H13: Therrien et al., 2000
H14: DFO (Stats. Div.), data
H24: J. Jenkins, p.c. 2001


3.2.8 : Atlantic herring
spring-spawning ground from Port Borden to North Cape
North Cape
GULF OF ST. LAWRENCE
Cap-Lumière
Anne-de-Kent
Saint-Thomas-de-Kent
Northumberland Strait
Kilometers

3.2.9 Atlantic herring fall-spawning ground at North Cape

Ecological Features

- Fall-spawning habitat for Atlantic herring is located in North Cape [h1,h2,h3,h4] (figure 3.2.9). Fall-spawning grounds are usually found at depths between 3 and 12.5 fathoms (5-20 m) [h4], but they can reach as deep as 15.5 fathoms (25 m). [h2]
- This site is one of the major fall-spawning areas near the Gulf coast of N.S. and around P.E.I. Other spawning areas are Fisherman's Bank and The Ridge (fact sheet 3.2.4), and Amet Sound to St. Georges Bay (3.2.3). [h2,h5]
- The main fall-spawning stock for the entire Southern Gulf is located in Chaleur Bay. The stocks of Pictou, Fisherman's Bank, and Escuminac-west of P.E.I. are almost equal at second rank. [h4,h5]
- The fall-spawners stock abundance remained high in recent years, and new high abundance year-classes (1995 and 1996) are now supporting the fishery. [h5] The estimated biomass of aged 4+ herring (by convention, age 0+ is the year of birth starting in January) is almost the highest since 1978, and the catch per unit of effort (CPUE) is the highest since 1978.
- This site is also used by spring-spawners (3.2.8).

Vulnerability, threats and human pressure

- The fall-spawners stock has been at a high level in recent years. The 1995 and 1996 year-classes are considered to be large and will be the main component of the fishery for the next years.
- The gear used in the inshore gillnet herring fishery *«...appears to be quite efficient at capturing herring with limited impacts to other species. There is little information on by-catch from this fishery or incidental damage to other fisheries or marine species.»* [h6]
- In 1985, Environment Canada stated that *«Roe fisheries, particularly herring and capelin, are lucrative for producers but entail significant waste problem since there is no market for fish carcasses. Eighty percent of the landed weight of herring is thrown away when only the roe is used.»* [h6] This statement is no longer the example in the Southern Gulf herring fishery. Unused portions of the fish are processed at smokehouses and fish meal plants. [h10] However, the problem associated with fish meal plants is that they are considered *«to have a greater environmental impact, because of high BOD and potential toxicity as a consequence of lowered dissolved oxygen.»* [h11]
- The land-based human presence that lays adjacent to the inshore area of this fact sheet has low population and minimal agricultural development. Due

to this, the anthropogenic factors are limited in comparison to other study areas of this report.

Socio-economic characteristics

- The herring fishery is of high economic importance in the Southern Gulf of St. Lawrence. Herring is the most important pelagic species by both weight and value landed in the Southern Gulf Region. The species is extensively fished in NAFO Division 4T(see map in appendix) overall (approximately 3500 inshore licenses and 6 seiner licenses). The fishery has been managed by Total Allowable Catch (TAC) since 1972. [h4]
- NAFO Division 4T landings for herring [h12] : (1975) 44,565t, (1980) 35,180t, (1985) 37,947t, (1990) 76,491t, (1995) 89,134t, and (1999) 71,886t.
- NAFO Division 4T sub-divides into 7 Herring Fishing Areas (HFA) for Canadian fisheries management purposes (see map in appendix). The HFA of 16E, 16F, and 16G represent all of the study area for this report (The southern and western boundaries between P.E.I. and N.B. in area 16E represent the transitional boundary from the northeast N.B. report area [h19]). An inshore fleet pursues most of the effort directed at herring in these three areas.
- 2000 TAC for the Division 4T fall-spawning stock was set at 71,000 t with 54,714 t available to inshore fleet. The 2000 landings for the 4T fall-spawning stock were 59,086t (inshore fleet: 50,398 t or 85%). The inshore CPUE in 2000 was equal to 1999. It was also the highest for 1978-2000. [h4]
- HFA 16E is the area closely associated with fact sheet 3.2.9 fishing effort. No detailed information is available on the effort. Licenses for commercial HFA 16E/C are 469 for P.E.I. and 617 for N.B.
- Herring landings [h14] occur predominately in statistical district 92 in P.E.I. (see map in appendix).

	10 year means (1990-99)		1999 landings	
	(metric tonnes)	($000)	(metric tonnes)	($000)
District 92	3,668	711	5,069	1,175
All districts Gulf N.S. and P.E.I.	19,445	3,710	27,863	6,481
Entire Gulf	61,428	10,560	64,828	14,374

- Landings in district 92 have been stable and trending upward in the 1990's. The five-year mean landings between 1990-94 was 2,377t. The five-year mean landings between 1995-99 was 4,959t. Landings in 1998 were the highest (5,904t) over the ten-year span (1990-99).

- The fall herring fishery is predominately a roe fishery carried out by inshore gillnet vessels. The season generally takes place in August and September, when the fish spawn. Japan is the major market for roe herring. Price fluctuations in this market tend to correlate with fishing effort.
- There are other important commercial species, besides herring, that are landed in statistical district 92. These species are (1999 landed value order over $100,000):

Species	Value ($000)	Licenses (valid)	Season
Lobster (LFA 24)	16,811	272	May 1- June 30
Snow Crab (Area 12)	3,495	16	July- Sept.
Mackerel	857	285	May- August
Cod (3PN, 4R, 4T, 4S, 4VN)	730	198 (unspecified groundfish)	Varies
Bluefin Tuna	337	100	August-Nov.
Irish Moss	293	112	Summer
Oyster	263	200	Apr. 15- July 15 (relay) Sept. 15- Nov. 15 (open)
Softshell Clam	254	161	Summer

Support, favourable and unfavourable factors

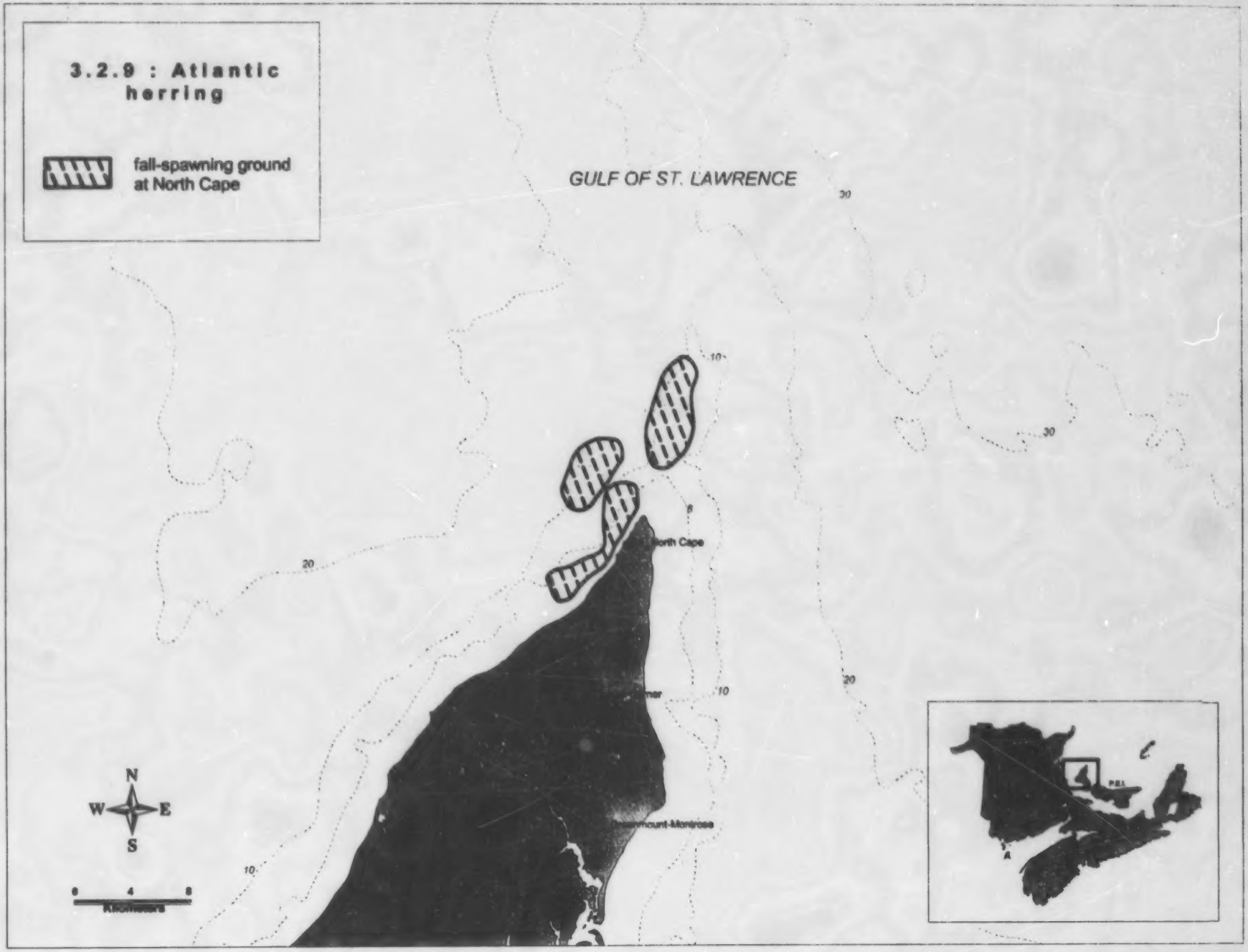
- There is currently a three year Integrated Fisheries Management Plan (IFMP) and an Annual Harvesting Plan.
- There is potential for a co-operative plan between DFO and the industry, similar to the one in 16F.

Other associated significant habitats

- The North Cape area is a significant habitat included in fact sheets or appendix for: Irish moss (3.1.2), cod (3.2.2), herring (3.2.8 spring-spawning), bluefin tuna (3.2.14), and harp seal (3.5.3), as well as grey seal (in appendix).
- Atlantic herring is associated with the following significant habitats: Amet Sound to St. Georges Bay (3.2.3), Fisherman's Bank an d The Ridge (3.2.4), Northumberland Strait (3.2.5), St. Lawrence Bay (3.2.6), Shediac Valley (3.2.7), and Borden to North Cape (3.2.8), as well as Baie Verte to Amet Sound (see appendix).

References

H1: MacNeil, J.L. & Assoc., 1998
H2: C. LeBlanc, p.c. 2001
H4: DFO (Herring), 2001c
H5: LeBlanc et al., 2001
H6: D. Cairns, p.c., 2001
H8: Davis et al., 2000, p.127
H9: Eaton et al., 1994, p.269.
H10: D. MacEwen, p.c., 2001
H11: Eaton et al., 1994, p.63
H12: NAFO, 2000
H13: Therrien et al., 2000
H14: DFO (Stats. Div.), data
H24: J. Jenkins, p.c. 2001


3.2.9 : Atlantic herring
fall-spawning ground at North Cape
GULF OF ST. LAWRENCE
30
30
20
10
10
20
10
North Cape
N
W
E
S
0
4
8
Kilometers
PEI

3.2.10 Atlantic mackerel spawning ground in St. Georges Bay

Ecological Features

- Atlantic mackerel spawning grounds are found in St. Georges Bay [m1,m2] (figure 3.2.10). The boundaries are approximate because the data comes from egg concentration assessment cruises with a relatively low spatial sampling density. [m2]
- Mackerel is a highly migratory fish. In the northwest Atlantic, it is considered to be of two separate stock components. The southern component spawns off the coast of New Jersey in the spring while the northern component, from George's Bank, spawns in the Southern Gulf of St. Lawrence. [m3]
- St. Georges Bay is the third main known mackerel spawning grounds for the Southern Gulf of St. Lawrence stock component. The more important spawning ground, by far, is found on Bradelle and Orphan Banks (fact sheet 3.2.11), while the second one is in Chaleur Bay. [m1,m4] There is also probably another minor spawning ground in Cape Tormentine. [m5] During its spring migration, mackerel can also spawn on the Scotian Shelf, inshore (ex.: St. Margarets Bay) and offshore (Sable Island area). [m1]
- Usually, the older and bigger spawners reach the Bradelle and Orphan Banks around mid-May. After they have spawned, they travel along the Quebec North Shore and the west coast of Newfoundland. They are also the last one to leave the Gulf (fall). [m1] Depending on the water temperature at the end of July and beginning of August in the Belles-Isle Straight, the mackerel can also migrate towards the east coast of Newfoundland. Spawners of average length enter the Gulf only in June, travel along the Cape Breton west coast down to Cheticamp and then reach the Bradelle and Orphan Banks. The smaller sized portion of the stock enters the Gulf later, in late-June or early-July. They then migrate to St. Georges Bay where they usually spawn in July. [m1] Some big and average length spawners also migrate to St. Georges Bay. In some years, the difference in size is not obvious, like in 2000 when all the fish were small, showing the presence of a new strong year-class. [m1,m2]
- St. Georges Bay is a very productive habitat characterised by bottom sediments dominated by sand and gravel with finer substrate in the centre of the bay. A wide surface (about 1000 km^2), a mean depth of 30 m, an average freshwater input of 37 m^3/s, water temperature reaching 19°C in summer, and the presence of 65 species of fish of which 23 are commercially harvested [m6] are some other characteristics of the bay. Several migratory species are present in the bay, notably alewife, blueback herring, eel, salmon, Atlantic sturgeon, bluefin tuna, sea trout, shad, and smelt. [m6] Numerous crustaceans and molluscs inhabit the bay, but most of the

shellfish areas are closed because of contamination. [m6,m7] Grey seals also inhabit the bay where they breed. [m6] More detailed information is also available in the fact sheet about the bay (3.6.3).

- From analyses done at the end of the 70's, it seems the partial closure of the Canso Strait with the building of the Canso Causeway in 1954 did not have any major impact on the mackerel population. [m6] The decline following this construction can be related to other factors such as water temperature or epizootic disease which also reduced herring population. The population fully recovered afterward. However, it may have had an impact locally, in St. Georges Bay and the surroundings, because it stopped the migration of mackerel through the Strait (northward in spring and southward in fall) even if the population was not jeopardised. [m6]

Vulnerability, threats and human pressure

- Mackerel is sensitive to water temperature changes, resulting in sharp fluctuations in the concentration areas and in the catch rate. [m2,m3] Yearly fluctuations in surface water temperature occur in the Southern Gulf of St. Lawrence.
- Because the Gulf population is overwintering on George's Banks, it is affected by American fishing pressure. [m3] Management of the northern spawning group becomes more difficult with different nations participating in the prosecution of the fishery.
- After squid and herring, Atlantic mackerel is a major prey for bluefin tuna. [m9]
- Bait and recreational fishing effort is not reported in catch statistics. [m2,m3] They constitute a significant contribution to the total effort and thus, the total harvest is underestimated.
- Due to the relationship between spawning cycle and surface water temperature, mackerel spawning may be affected by long term climate changes.
- Since the narrowing of the Canso Strait, with the building of the Canso Causeway in 1952-54, there has been no evidence that the volume of water and the flushing time is different now than it was prior to 1952. [m6] Therefore, there has been a substantial increase in the velocity of current outgoing from the bay to the strait that may have caused a dramatic decrease, or even the complete blockage, of the fish migration from the Strait.
- Water quality in St. Georges Bay is considered to be good. «*The water, sediment and biota of St. Georges Bay have been sampled for various contaminants. Heavy metals, PCBs, and organochlorines have been analysed and are generally at relatively low levels. St. Georges Bay is often considered "clean" and used as a reference site, however sensitive test using MFO induction indicate there may be some contamination of the environment.*» [m6]

Socio-economic characteristics

- Recreational fishing of mackerel has a long history in the St. Georges Bay area. There has also been a mackerel fishing derby held in the bay since 1989.
- Historically, mackerel was an important fishery in the Southern Gulf Region.[m10] Currently, mackerel is considered an under-utilised species.[m9] Mackerel is fished in NAFO Division 4T (see map in appendix) overall (3137 limited licenses and 1598 bait licenses).
- Atlantic mackerel landings showed a sharp decrease in the late 70's and, after a slight increase in the mid 80's, they have gradually decreased since the late 80's.[m2,m9] However, these fluctuations were related to the type of management regime that was in place instead of the variations in abundance. The first decrease was in fact due to the establishment of the 200 miles exclusive economic zone (EEZ), and the second to the reduction of the U.S.A. quotas. The 200,000t quota was initially divided in half between Canada and U.S.A., as proposed by Canada.[m9] The Canadian quota is still of 100,000t, but will be reduced to 80,000t in 2002.[m1]
- Landings of mackerel in some provinces appear to be greatly underestimated since a large portion of the mackerel (bait) is not sold to processing plants and therefore does not show up in the official statistics.
- The mackerel fishery is *«...chiefly an inshore fishery and the most commonly used gear types are gillnets, handlines, purse seines and traps, in decreasing order of importance. Their utilisation depends on the area and time of year».*[m9]
- The whole Division 4T encompasses Mackerel Fishing Area (MFA) 16 for management purposes.
- NAFO Division 4T landings[m11] for mackerel: [1975] 2,126t (Canadian landings prior to 1977 EEZ), [1980] 8,070t, [1985] 7,774t, [1990] 9,032t, [1995] 8,181t, and [1999] 10,354t. Canadian landings represent the total of all landings in NAFO Division 4T since 1977. However, Russian vessels fished mackerel in the 80's on the west coast of Newfoundland. In the 90's Russian vessels again harvested mackerel in the Gulf, Chaleur Bay and northwest of N.B. Direct offshore sales occurred, but were not reported.[m1] Logbooks are presently in use on a voluntary basis, but will be gradually obligatory in the near future.
- Statistical districts 3, 13, and 14 (see map in appendix) are closely associated with fact sheet 3.2.10 fishing effort. Limited licenses for mackerel in these districts are 123 for district 3, 116 for district 13, and 6 for district 14. Bait licenses for mackerel in these districts are 67 for district 3, 69 for district 13, and 2 for district 2.
- The recent landings were as follow :

	10 year means (1990-99)		1999 landings	
	(metric tonnes)	($000)	(metric tonnes)	($000)
District 3,13,14	128	65	118	63
All districts	4,823	2,160	4,008	1,937
Gulf N.S. and P.E.I.				
Entire Gulf	2,160	2,999	5,312	2,626

- There are other important commercial species, besides mackerel, that are landed in statistical districts 3, 13, and 14. These species are (1999 landed value order over $100,000):

Species	Value ($000)	Licenses (valid)	Season
Lobster (LFA 26 A & B)	13,700	268	May 1-June 30
Bluefin Tuna	1,779	92	Aug.- Nov.
Snow Crab (Area 18 & 19)	1,544	35	July- Sept.
American Plaice (3PN, 4R, 4T, 4S, 4VN)	228	162 (unspecified groundfish)	Varies
Winter Flounder (3PN, 4R, 4T, 4S, 4VN)	161	162 (unspecified groundfish)	Varies
White Hake (3PN, 4R, 4T, 4S, 4VN)	152	162 (unspecified groundfish)	Closed (By-catch & Sentinel only)

Support, favourable and unfavourable factors

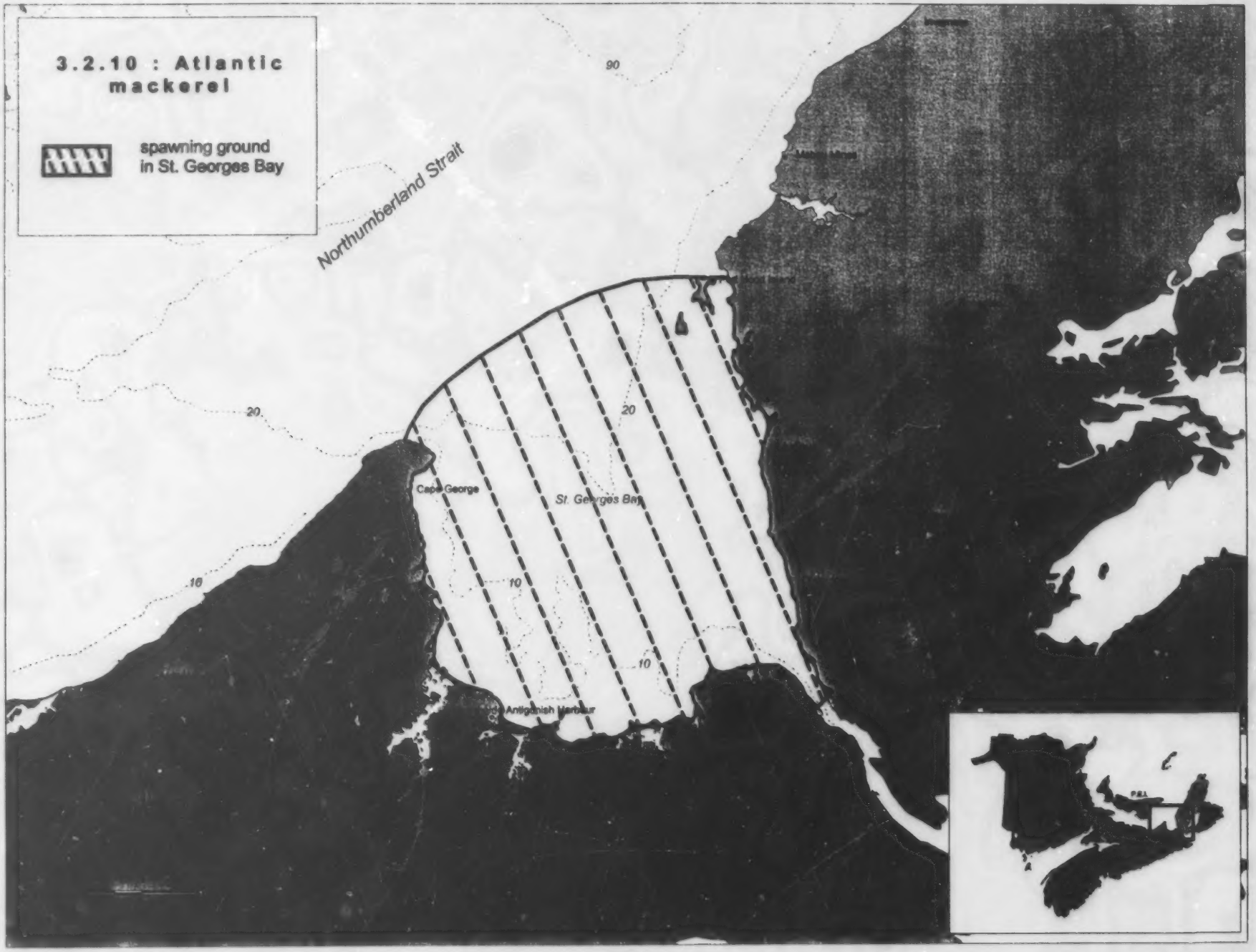
- The St. Georges Bay Ecosystem Project (GBEP) is a collaborative partnership between St. Francis Xavier University, marine harvester's organisations, Mi'kmaq Fish & Wildlife Commission (MFWC) and Fisheries & Oceans Canada. The intent of the project is to document and conduct applied analyses of the marine and human ecology of St. Georges Bay. This includes the area between Lismore, Pictou County and Pleasant Bay, Inverness County.
- Multi-year management plans are developed for mackerel by DFO and supported by fishers, under the conservation of the resource principle for long-term sustainable utilisation.
- Co-management of the resource would ensure full participation by the stakeholders, developing partnerships where applicable.
- Mackerel is a source of food for larger pelagic species such as tuna. The species would warrant an ecosystem-based approach for management in this area.

Other associated significant habitats

- The St. Georges Bay area is a significant habitat included in fact sheets or appendix for: Irish moss (3.1.2), herring (3.2.3, 3.2.5), white hake (3.2.12), bluefin tuna (3.2.14), grey seal (3.5.1), and St. Georges Bay (3.6.3).
- Atlantic mackerel is also associated with the following significant habitats: Bradelle and Orphan Banks (3.2.11).

References

M1: F. Grégoire, p.c., 2001
M2: Grégoire et al., 2001
M3: DFO (mackerel), 2001e
M4: Therrien et al., 2000
M5: MacNeil, J.L. & Assoc., 1998
M6: Davis et al., 2000, and several authors cited within
M7: MacNeil, J.L. & Assoc., 2001
M8: McCraken, 1979
M9: Clay and Hurlbut, 1988
M10: Perley, 1852
M11: NAFO, 2000
M12: DFO (Stats. Div.), data


3.2.10 : Atlantic mackerel
spawning ground in St. Georges Bay
Northumberland Strait
90
20
20
10
10
10
Cape George
St. Georges Bay
Antigonish Harbour

3.2.11 Atlantic mackerel spawning ground on Bradelle and Orphan Banks

Ecological Features

- Atlantic mackerel spawning grounds are found on Bradelle and Orphan Banks [m1,m2] (figure 3.2.11). The boundaries are approximate because of annual variability, but egg concentration assessment cruises show a relatively consistent high density in this general area. [m2]
- Mackerel is a highly migratory fish and in the northwest Atlantic it is considered to be of two separate stock components. The southern group spawns off the coast of New Jersey in the spring. While the northern component, from George's Bank, spawns in the Southern Gulf of St. Lawrence. [m3]
- It is the main known mackerel spawning ground for the Canadian stock. Other important spawning grounds are found in Chaleur Bay[m1,m4], St. Georges Bay (fact sheet 3.2.10), and probably another minor one in Cape Tormentine. [m5] During its spring migration, mackerel can also spawn on the Scotian Shelf, inshore (ex.: St. Margarets Bay) and offshore (Sable Island area). [m1]
- Usually, the older and bigger spawners reach the Bradelle and Orphan Banks around mid–May. After they have spawned, they travel along the Quebec North Shore and the west coast of Newfoundland. They are also the last to leave the Gulf (fall). [m1] Depending on water temperature conditions at the end of July and beginning of August in the Belles-Isle Straight, the mackerel can also migrate towards the east coast of Newfoundland. Spawners of average length enter the Gulf only in June, travel along the Cape Breton west coast down to Cheticamp and then reach the Bradelle and Orphan Banks. Smaller mackerels enter the Gulf later, in late-June or early-July. They then migrate near and into St. Georges Bay where they usually spawn in July and August. [m1] Some big and average length spawners also migrate to St. Georges Bay. In some years, the difference in size is not obvious, like in 2000 when all the fish were small, showing the presence of a new strong year-class. [m1,m2]

Vulnerability, threats and human pressure

- Mackerel is sensitive to water temperature changes, resulting in sharp fluctuations in the concentration areas and in the catch rate. [m2,m3] Yearly fluctuations in surface water temperature occur in the Southern Gulf of St. Lawrence.
- Because the Gulf population is overwintering in the George's Banks area, it is affected by American fishing pressure. [m3] Management of the northern

spawning group becomes more difficult with different nations participating in the prosecution of the fishery. The situation could be worse in the eventuality of the reopening of the International fishery which was responsible in the 1970 of the annual catches of several thousands tonnes of mackerel.

- After squid and herring, Atlantic mackerel is a major prey for bluefin tuna. [m9]
- Bait and recreational fishing effort is not reported in catch statistics. [m2,m3] They probably constitute a significant contribution to the total effort and thus, the total harvest is underestimated.
- Due to the relationship between spawning cycle and surface water temperature, mackerel spawning may be affected by long term climate changes.

Socio-economic characteristics

- Historically, mackerel was an important fishery in the Southern Gulf Region. [m10] Currently, mackerel is considered an under-utilised species. [m3] Mackerel is fished in NAFO Division 4T (see map in appendix) overall (3137 limited licenses and 1598 bait licenses).
- Atlantic mackerel landings showed a sharp decrease in the late 70's and, after a slight increase in the mid 80's, they have gradually decreased since the late 80's. [m2,m3] However, these fluctuations were related to the type of management regime that was in place instead of the variations in abundance. The first decrease was due to the establishment of the 200 miles exclusive economic zone (EEZ), and the second to the reduction of the U.S.A. quotas. The 200,000t quota was initially divided in half between Canada and U.S.A., as proposed by Canada. [m3] The Canadian quota is still of 100,000t, but will be reduced to 80,000t in 2002. [m1]
- Landings of mackerel in some provinces appear to be greatly underestimated since a large portion of the mackerel (bait) is not sold to processing plants and therefore does not show up in the official statistics.
- The mackerel fishery is *«...chiefly an inshore fishery and the most commonly used gear types are gillnets, handlines, purse seines and traps, in decreasing order of importance. Their utilisation depends on the area and time of year»*. [m3]
- The whole Division 4T encompasses Mackerel Fishing Area (MFA)16 for management purposes.
- NAFO Division 4T landings [m11] for mackerel: [1975] 2,126t (Canadian landings prior to 1977 EEZ), [1980] 8,070t, [1985] 7,774t, [1990] 9,032t, [1995] 8,181t, and [1999] 10,354t. Canadian landings represent the total of all landings in NAFO Division 4T since 1977. However, Russian vessels fished mackerel in the 80's on the west coast of Newfoundland. In the 90's Russian vessels again harvested mackerel in the Gulf, Chaleur Bay and northwest of N.B. Direct offshore sales occurred, but were not reported. [m1]

Logbooks are presently in use on a voluntary basis, but will be gradually obligatory in the near future.

- Significant catches of mackerel on the north shore of P.E.I. occur in statistical districts 88 and 92 (see map in appendix). Limited licenses for mackerel in these districts are 291 for district 88, and 285 for district 92. Bait licenses for mackerel in these districts are 208 for district 88, and 249 for district 92.
- Recent landings were as follow :

	10 year means (1990-99)		1999 landings	
	(metric tonnes)	($000)	(metric tonnes)	($000)
District 88	705	342	537	249
District 92	1,940	890	1,832	862
All districts Gulf N.S. and P.E.I.	4,823	2,160	4,008	1,937
Entire Gulf	2,160	2,999	5,312	2,626

- There are other important commercial species, besides mackerel, that are landed in statistical district 88. These are (1999 landed value order over $100,000):

Species	Value ($000)	Licenses (valid)	Season
Lobster (LFA 24)	21,649	283	May 1-June 30
Mussel	2,352	32	Summer (wild) Year round (aquaculture)
Cod (3PN, 4R, 4T, 4S, 4VN)	746	214 (unspecified groundfish)	Varies
Snow Crab	546	3	July- Sept.
Herring	486	147	Aug.- Sept.
American Plaice	230	214 (unspecified groundfish)	Varies
Toad Crab	156	N/A	N/A
Rock Crab	120	4	Aug. 16- Nov. 13 (1999)

- For districts 92, these are (1999 landed value order over $100,000):

Species	Value ($000)	Licenses (valid)	Season
Lobster (LFA 24)	16,811	272	May 1- June 30
Snow Crab (Area 12)	3,495	16	July- Sept.
Mackerel	857	285	May- August
Cod (3PN, 4R, 4T, 4S, 4VN)	730	198 (unspecified groundfish)	Varies

Bluefin Tuna	337	100	August-Nov.
Irish Moss	293	112	Summer
Oyster	263	200	Apr. 15- July 15 (relay) Sept. 15- Nov. 15 (open)
Softshell Clam	254	161	Summer

Support, favourable and unfavourable factors

- A DFO Laurentian Region study has identified this site for protection because it is used by mackerel and cod for spawning. The same study referred to sand and silt bottoms habitats on Bradelle Bank, which also contain snow crab concentrations.[M13]
- Multi-year management plans are developed for mackerel under the conservation of the resource principle for long-term sustainable utilisation.
- Co-management of the resource to ensure full participation by the stakeholders, developing partnerships where applicable.
- Mackerel is a source of food for larger pelagic species such as tuna. The species would warrant an ecosystem-based approach for management of this area.
- There are some concerns regarding by-catch of herring and gear conflicts with crab fleets.

Other associated significant habitats

- The Bradelle and Orphan Banks are significant habitats included in fact sheets for: Atlantic cod (3.2.2), bluefin tuna (3.2.14), and harp seal (3.5.3).
- Atlantic mackerel is also associated with the following significant habitats: St. Georges Bay (3.2.10).

References

M1: F. Grégoire, p.c., 2001

M2: Grégoire et al., 2001

M3: DFO (mackerel), 2001e

M4: Therrien et al., 2000

M5: MacNeil, J.L. & Assoc., 1998

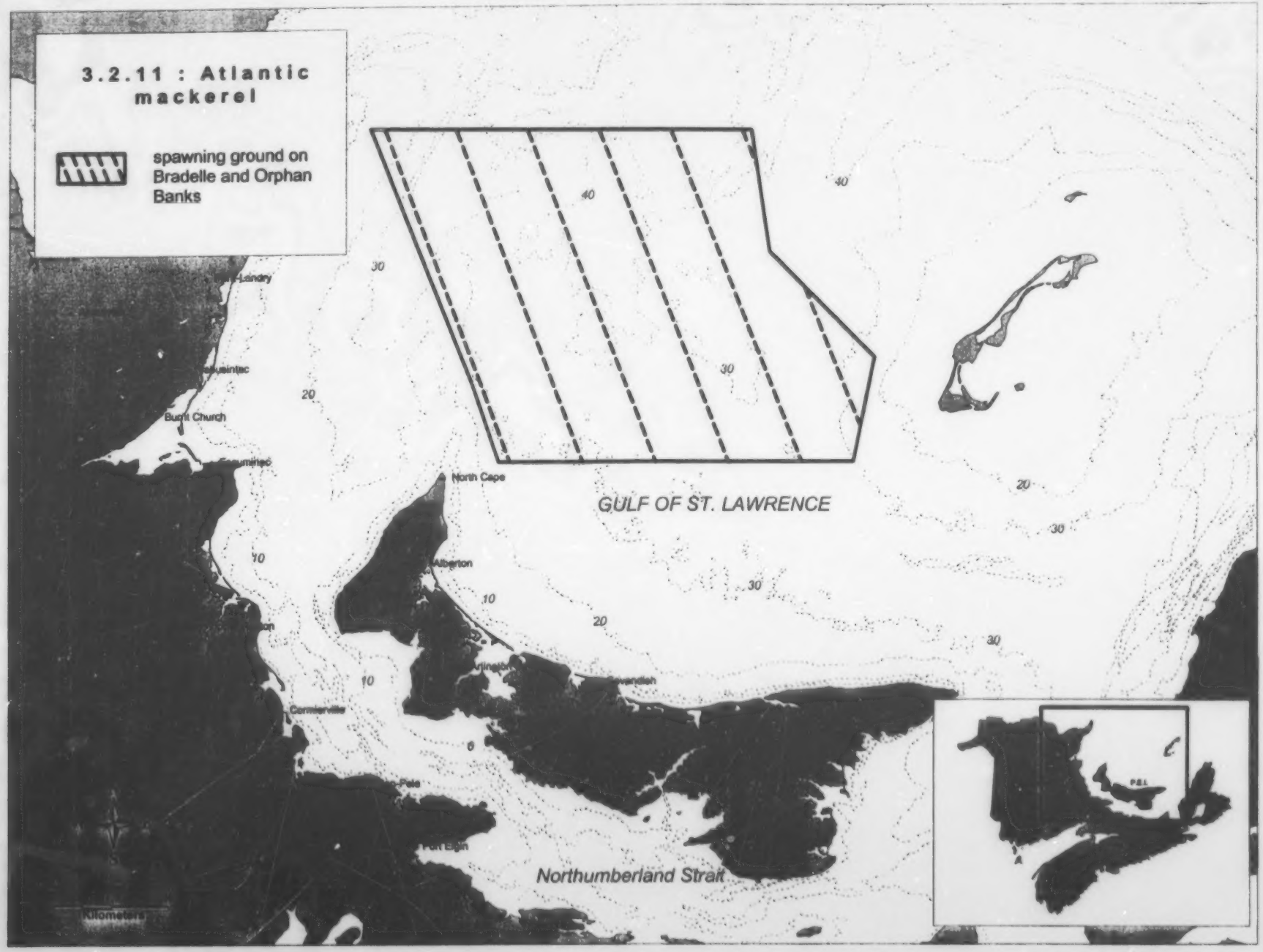
M9: Clay and Hurlbut, 1988

M10: Perley, 1852

M11: NAFO, 2000

M12: DFO (Stats. Div.), data

M13: DFO, 1998a


3.2.11 : Atlantic mackerel
spawning ground on Bradelle and Orphan Banks
GULF OF ST. LAWRENCE
Northumberland Strait
North Cape
Burnt Church
Caraquet
Alberton
Tignish
Cornerville
Pictou
Port Elgin
Kilometers
PEI
40
30
20
10
0

3.2.12 White hake spawning ground in St. Georges Bay

Ecological Features

- Spawning and nursery habitat for white hake are located in St. Georges Bay [w1,w2] (figure 3.2.12). Habitat boundaries are not well documented or defined. It is thought that the spawning ground was more widespread and better populated until the early 1990's when there was a sharp drop in the abundance of the stock. Presently, it is considered to be the principle spawning ground in the Southern Gulf. [w1,w2] The other main spawning grounds, now less or scarcely utilised, are Baie Verte [w1,w3] and off the coast of P.E.I. [w2]
- Evidence from several studies indicates that there are probably two different stock components in the Southern Gulf. One of the components occurs in shallow waters (< 100 m) of the Northumberland Strait, while the other is found in deeper waters (> 200 m) along the Laurentian Channel. [w4]
- The latest (2000) survey results indicate that the abundance of white hake in NAFO Division 4T (see map in appendix) has increased because of increasing recruitment. However, the low abundance of commercial-size fish, below average population biomass, and the evidence that suggests that the distribution of white hake has become more concentrated during the 1990's is a concern. The higher catch rate in the 2000 survey was due to the catch of relatively small (30 cm –40 cm) fish. [w5] The abundance index for the Strait stock component declined to its lowest level since the moratorium implemented in 1995. The Strait component has contributed the majority of the landings in the Southern Gulf (90%). [w4] The main areas of concentration in the 2000 survey, were along the Laurentian Channel, in the Cape Breton Trough and in St. Georges Bay. It is considered scarce in other parts of the Southern Gulf. [w5]
- There is little information about the spawning or nursery areas [w2] of white hake in the Gulf of St. Lawrence. There is anecdotal evidence (reported by scientists and fishers) of spawning in eelgrass beds (0-3 m depth), which are then used as nursery areas by juveniles. Young-of-the-year hake may be found in nearshore areas with depths between 1-10 m. [w2] Adult white hake seem to prefer water temperatures between 5 and 11°C and soft bottoms. White hake in the Southern Gulf undergo a migration in the autumn, similar to that of cod, to the deeper waters of the Laurentian Channel in the 4Vn area.
- Spawning usually occurs mainly from mid-June to mid-July. [w4]
- The geographical distribution of white hake in the Southern Gulf is relatively narrow. [w5] Distribution is concentrated in a small portion of the area occupied by the stock prior to the 1990's.

- St. Georges Bay is a very productive habitat characterised by bottom sediments dominated by sand and gravel with finer substrate in the centre of the bay. A wide surface (about 1000 km^2), a mean depth of 30 m, an average freshwater input of 37 m^3/s, water temperature reaching 19°C in summer, and the presence of 65 species of fish of which 23 are commercially harvested[w7] are some other characteristics of the bay. Several migratory species are present in the bay, notably alewife, blueback herring, eel, salmon, Atlantic sturgeon, bluefin tuna, sea trout, shad, and smelt.[w7] Numerous crustaceans and molluscs inhabit the bay, but most of the shellfish areas are closed because of contamination.[w7,w8] Grey seals also inhabit the bay where they breed.[w7] More detailed information is also available in the fact sheet about the bay (3.6.3).
- St. Georges Bay is also a nursery habitat for white hake (fact sheet 3.2.13).

Vulnerability, threats and human pressure

- The abundance of white hake in the Southern Gulf of St. Lawrence fell sharply in the early 1990s. The closure of the fishery in 1995 appears to have arrested the decline but the stock remains low.[w6]
- The white hake resource in the Southern Gulf remains vulnerable because of its low biomass and reduced range of distribution. This resource appears to be in the early stages of a potential recovery with little change in the commercial stock anticipated in the short-term.
- The natural mortality rate remains high, but the causes are unknown.[w6] Groundfish trawling in the 1980's and scallop dragging, which is still practiced, may be detrimental to this habitat. Any perturbation in shallow water habitats, especially where aquatic vegetation is present, may be detrimental to white hake spawning or nursery areas.
- By-catches of white hake occur in other groundfish fisheries, especially those targeting cod, winter flounder, and redfish.
- Fisheries Resource Conservation Council (FRCC) recommendations for white hake in the Southern Gulf suggest closure until at least 2004 and the possible reduction of effort or closure of fisheries in St. Georges Bay that adversely affected white hake or have too large a by-catch of juvenile hake. Restrictions have been in place since 1997 that attempt to reduce the by-catch of juvenile hake. «*...to further minimize the by-catch of cod and white hake, the DFO implemented restrictive fishing seasons for both the fixed and mobile gear sectors directed at other species. The purpose of this management measure was to permit cod and hake migration to completed before opening the area to other groundfish activity. As well, the fishing season for mobile gear in the eastern portion of the Northumberland Strait was adjusted to open on July 15 to allow hake to spawn. The DFO also enforced a licensing condition that required fishers directing for smelts in the*

fall and winter fisheries to sort and release all groundfish (i.e., white hake and winter flounder) from their fishing gear.» [W12]

- Water quality in St. Georges Bay is considered to be good. «*The water, sediment and biota of St. Georges Bay have been sampled for various contaminants. Heavy metals, PCBs, and organochlorines have been analysed and are generally at relatively low levels. St. Georges Bay is often considered "clean" and used as a reference site, however sensitive test using MFO induction indicate there may be some contamination of the environment.*» [W11]

Socio-economic characteristics

- The white hake fishery was an economically important groundfish fishery in the eastern Northumberland Strait and St. Georges Bay area from the mid part of the 20th century until the moratorium. The white hake fishery in the Southern Gulf (NAFO Division 4T) has been under a moratorium since 1995.
- «*The fishery for white hake in NAFO Division 4T has historically been the third or fourth most important groundfish fishery in the Southern Gulf, with annual landings that averaged 5,675 t from 1960-1994. The hake fishery was carried out mainly by small inshore vessels and was strongly affected by weather and local market conditions. Both fixed and mobile gears were used in the hake fishery, which was concentrated in the Northumberland Strait, on the Western end of P.E.I. and between P.E.I. and Cape Breton Island.*» [W4]
- NAFO Division 4T landings [W6] of white hake: [1975] 4,125t, [1980] 12,423t, [1985] 6,014t, [1990] 5,175t, [1995] 70t, and [1999] 399t.
- Statistical districts 3, 13, and 14 are closely associated with fact sheet 3.2.12 fishing effort. Landings in these districts are accounted for by sentinel fisheries, by-catch, and recreational fisheries. Currently, there is no directed fishery for white hake in the Southern Gulf. There are 162 unspecified groundfish licenses in district 3, 13, and 14.

	5 year means (1990-94)		1999 landings	
	(metric tonnes)	($000)	(metric tonnes)	($000)
Districts 3,13,14	852	526	108	154
All districts	1,372	664	392	471
Gulf N.S. and P.E.I.				
Entire Gulf	1,523	745	402	488

- There are other important commercial species besides white hake that are landed in statistical districts 3, 13, and 14. These species are (1999 landed value order over $100,000):

Species	Value ($000)	Licenses (valid)	Season
Lobster (LFA 26 A & B)	13,700	268	May 1-June 30
Bluefin Tuna	1,779	92	Aug.- Nov.
Snow Crab (Area 18 & 19)	1,544	35	July- Sept.
American Plaice (3PN, 4R, 4T, 4S, 4VN)	228	162 (unspecified groundfish)	Varies
Winter Flounder (3PN, 4R, 4T, 4S, 4VN)	161	162 (unspecified groundfish)	Varies

Support, favourable and unfavourable factors

- A number of commercial fishers expressed concern about white hake stocks as early as the 1980's. Fishers would be in favour of any action that would contribute to stock recovery.
- The white hake fishery in NAFO Division 4T has remained under moratorium since 1995.
- The St. Georges Bay Ecosystem Project (GBEP) is a collaborative partnership between St. Francis Xavier University, marine harvester's organisations, Mi'kmaq Fish & Wildlife Commission (MFWC) and Fisheries & Oceans Canada. The intent of the project is to document and conduct applied analyses of the marine and human ecology of St. Georges Bay. This includes the area between Lismore, Pictou County and Pleasant Bay, Inverness County.
- Sentinel fishery - DFO partnering with the Federation of Gulf N.S. Groundfish fishers.

Other associated significant habitats

- The St. Georges Bay area is a significant habitat included in fact sheets or appendix for: Irish moss (3.1.2), herring (3.2.3, 3.2.5), mackerel (3.2.10), white hake (nursery-3.2.13), bluefin tuna (3.2.14), grey seal (3.5.1), and St. Georges Bay (3.6.3).
- White hake is also associated with the following significant habitats: Southern Gulf (3.2.13).

References

W1: G. Chouinard, p.c., 2001

W2: T. Hurlbut, p.c. 2000

W3: Therrien et al., 2000

W4: DFO (white hake), 2001b

W5: Poirier et al., 2000

W6: Hurlbut and Poirier, 2001

W7: Davis et al., 2000, and several authors cited within

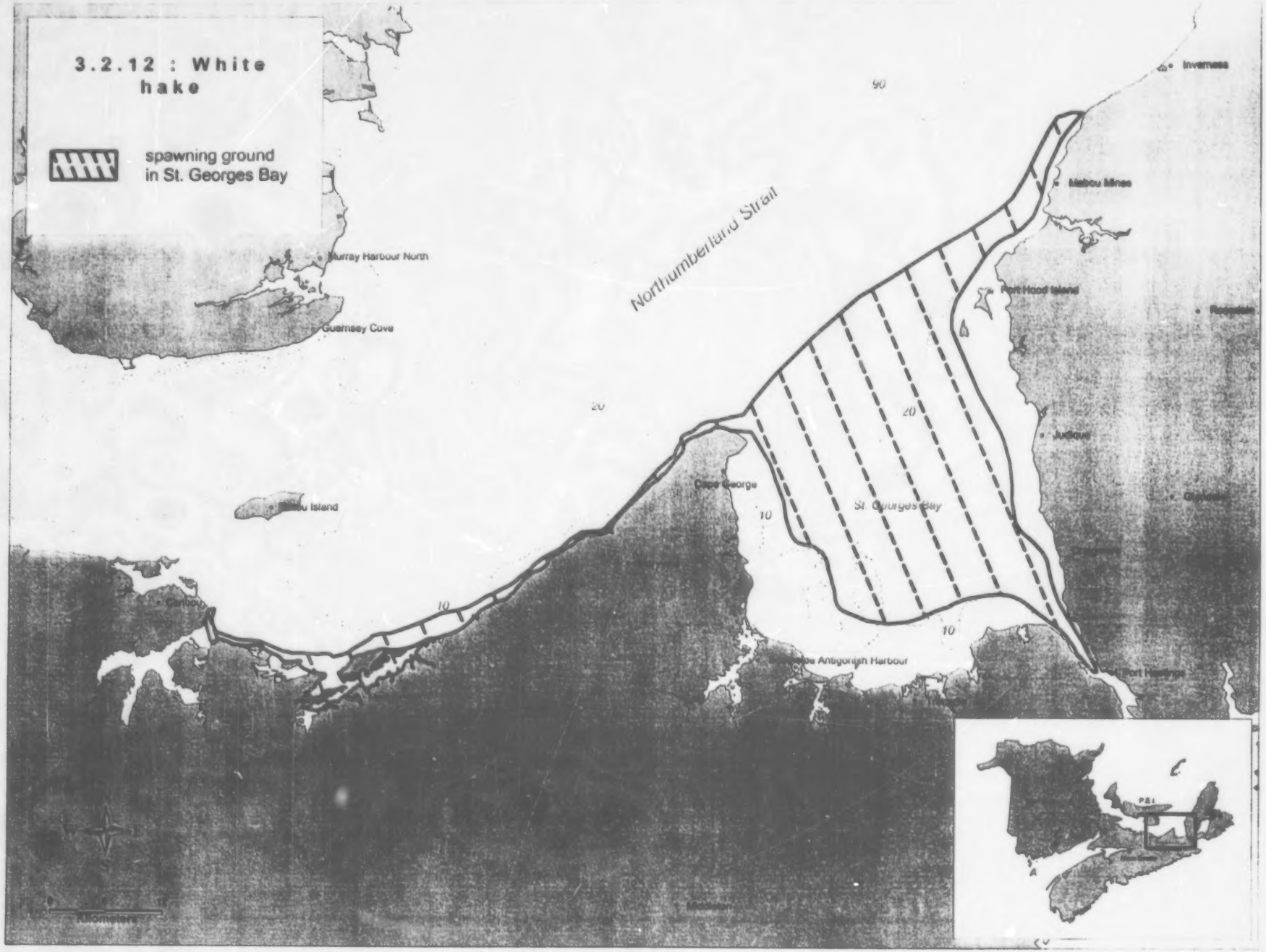
W8: MacNeil, J.L. & Assoc., 2001

W9: NAFO, 2000

W10: DFO (Stats. Div.), data

W11: Davis et al., 2000

W12: Hurlbut et al., 1998


3.2.12 : White hake
spawning ground in St. Georges Bay
Northumberland Strait
Murray Harbour North
Guernsey Cove
Inverness
Mabou Mines
Port Hood Island
Judique
Cape George
St. Georges Bay
Antigonish Harbour
90
20
10

3.2.13 White hake nursery in Southern Gulf

Ecological Features

- Nursery habitat for white hake is considered to be associated with shallow (0-3 m) eelgrass beds. In the Southern Gulf, the following areas have been recognised as potential or currently used nursery habitat: from Pictou to Inverness in N.S. (including St. Georges Bay), the east coast of P.E.I. from East Point to Hillsborough Bay, as well as Cascumpec and Malpeque Bays [w2] (figure 3.2.13). Habitat boundaries are not well documented or defined.
- Evidence from several studies indicates that there are probably two different stock components in the Southern Gulf. One of the components occurs in shallow waters (< 100 m) of the Northumberland Strait, while the other is found in deeper waters (> 200 m) along the Laurentian Channel. [w4]
- The latest (2000) survey results indicate that the abundance of white hake in NAFO Division 4T (see map in appendix) has increased because of increasing recruitment. However, the low abundance of commercial-size fish, below average population biomass, and the evidence that suggests that the distribution of white hake has become more concentrated during the 1990's is a concern. The higher catch rate in the 2000 survey was due to the catch of relatively small (30 cm –40 cm) fish. [w5] The abundance index for the Strait stock component declined to its lowest level since the moratorium implemented in 1995. The Strait component has contributed the majority of the landings in the Southern Gulf (90%). [w4] The main areas of concentration in the 2000 survey, were along the Laurentian Channel, in the Cape Breton Trough and in St. Georges Bay. It is considered scarce in other parts of the Southern Gulf. [w5]
- There is little information about the spawning or nursery areas [w2] of white hake in the Gulf of St. Lawrence. There is anecdotal evidence (reported by scientists and fishers) of spawning in eelgrass beds (0-3 m depth), which are then used as nursery areas by juveniles. Young-of-the-year hake may be found in nearshore areas with depths between 1-10 m. [w2] Adult white hake seem to prefer water temperatures between 5 and 11°C and soft bottoms. White hake in the Southern Gulf undergo a migration in the autumn, similar to that of cod, to the deeper waters of the Laurentian Channel in the 4Vn area.
- Spawning usually occurs mainly from mid-June to mid-July. [w4]
- The geographical distribution of white hake in the Southern Gulf is relatively narrow. [w6] Distribution is concentrated in a small portion of the area occupied by the stock prior to the 1990's.

- Information about the productivity in specific areas can be gathered in other fact sheets, particularly for Pictou Harbour (3.6.1), St. Georges Bay (3.6.3), Basin Head (3.6.7), and Malpeque Bay (3.4.4).

Vulnerability, threats and human pressure

- The abundance of white hake in the Southern Gulf of St. Lawrence fell sharply in the early 1990s. The closure of the fishery in 1995 appears to have arrested the decline but the stock remains low. [46]
- The white hake resource in the Southern Gulf remains vulnerable because of its low biomass and reduced range of distribution. This resource appears to be in the early stages of a potential recovery with little change in the commercial stock anticipated in the short-term.
- The natural mortality rate remains high, but the causes are unknown. [46] Groundfish trawling in the 1980's and scallop dragging, which is still practiced, may be detrimental to this habitat. Any perturbation in shallow water habitats, especially where aquatic vegetation is present, may be detrimental to white hake spawning or nursery areas.
- By-catches of white hake occur in other groundfish fisheries, especially those targeting cod, winter flounder, and redfish.
- Fisheries Resource Conservation Council (FRCC) recommendations for white hake in the Southern Gulf suggest closure until at least 2004 and the possible reduction of effort or closure of fisheries in St. Georges Bay that adversely affected white hake or have too large a by-catch of juvenile hake. Restrictions have been in place since 1997 that attempt to reduce the by-catch of juvenile hake. «*...to further minimize the by-catch of cod and white hake, the DFO implemented restrictive fishing seasons for both the fixed and mobile gear sectors directed at other species. The purpose of this management measure was to permit cod and hake migration to completed before opening the area to other groundfish activity. As well, the fishing season for mobile gear in the eastern portion of the Northumberland Strait was adjusted to open on July 15 to allow hake to spawn. The DFO also enforced a licensing condition that required fishers directing for smelts in the fall and winter fisheries to sort and release all groundfish (i.e., white hake and winter flounder) from their fishing gear.*» [46]

Socio-economic characteristics

- The white hake fishery was an economically important groundfish fishery in the eastern Northumberland Strait and St. Georges Bay area from the mid part of the 20th century until the moratorium. The white hake fishery in the Southern Gulf (NAFO Division 4T) has been under a moratorium since 1995.

- *«The fishery for white hake in NAFO Division 4T has historically been the third or fourth most important groundfish fishery in the Southern Gulf, with annual landings that averaged 5,675 t from 1960-1994. The hake fishery was carried out mainly by small inshore vessels and was strongly affected by weather and local market conditions. Both fixed and mobile gears were used in the hake fishery, which was concentrated in the Northumberland Strait, on the Western end of P.E.I. and between P.E.I. and Cape Breton Island.»* [W4]
- NAFO Division 4T landings [W3] of white hake: [1975] 4,125t, [1980] 12,423t, [1985] 6,014t, [1990] 5,175t, [1995] 70t, and [1999] 399t.
- Statistical districts 92 and 82 (see map in appendix) are closely associated with fact sheet 3.2.13 fishing effort and show the biggest portion of the landings. Landings in these districts are accounted for by sentinel fisheries, by-catch, and recreational fisheries. There is no directed white hake fishery.

	5 year means (1990-94)		1999 landings	
	(metric tonnes)	($000)	(metric tonnes)	($000)
District 82	142	61	49	59
District 92	250	108	76	87
All districts Gulf N.S. and P.E.I.	1,372	664	392	471
Entire Gulf	1,523	745	402	488

- There are other important commercial species, besides white hake, that are landed in statistical districts 82 and 92. These are (1999 landed value order over $100,000):

Species	Value ($000)	Licenses (valid)	Season
Lobster (LFA 24)	16,811	272	May 1- June 30
Lobster (LFA 25)	14,335	153	Mid Aug.-Mid Oct.
Snow Crab (Area 12)	3,495	16	July- Sept.
Herring	1,175	228	Aug.- Sept.
Cod (3PN, 4R, 4T, 4S, 4VN)	730	198 (unspecified groundfish)	Varies
Mackerel	548	158	May – Sept.
Bluefin Tuna	337	100	August-Nov.
Irish Moss	1148	261	Summer
Scallop (SFA 22)	385	44	May -June
Oyster	263	200	Apr. 15- July 15 (relay) Sept. 15- Nov. 15 (open)
Softshell Clam	254	161	Summer
Rock Crab	340	4	May- June

Support, favourable and unfavourable factors

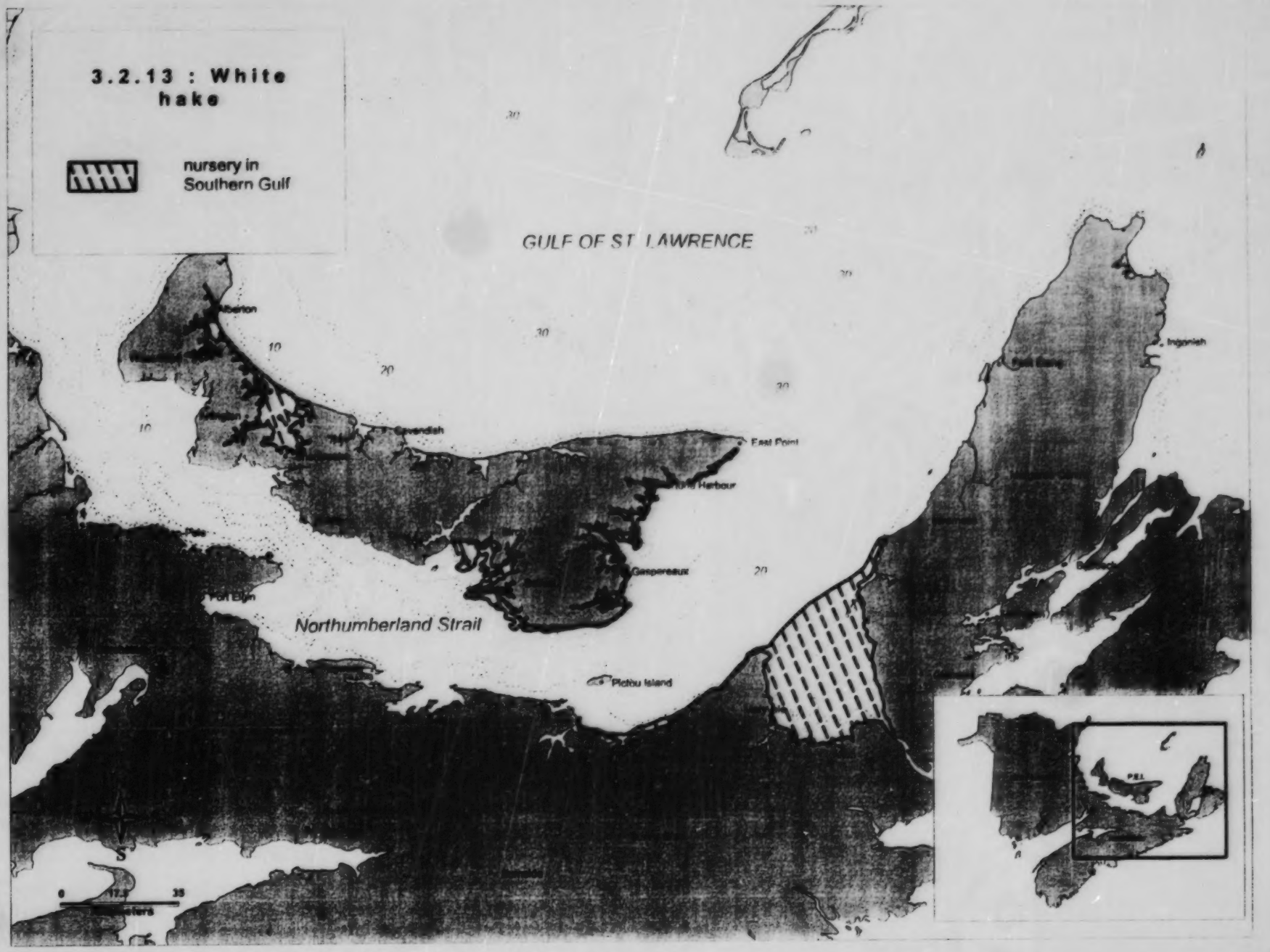
- A number of commercial fishers expressed concern about white hake stocks as early as the 1980's. Fishers would be in favour of any action that would contribute to stock recovery.
- The white hake fishery in NAFO Division 4T has remained under moratorium since 1995.
- The St. Georges Bay Ecosystem Project (GBEP) is a collaborative partnership between St. Francis Xavier University, marine harvester's organisations, Mi'kmaq Fish & Wildlife Commission (MFWC) and Fisheries & Oceans Canada. The intent of the project is to document and conduct applied analyses of the marine and human ecology of St. Georges Bay. This includes the area between Lismore, Pictou County and Pleasant Bay, Inverness County.
- Sentinel fishery - DFO partnering with Federation of Gulf N.S. Groundfish fishers.

Other associated significant habitats

- The Southern Gulf nursery areas are significant habitats included in fact sheets or appendix for: Irish moss (3.1.2), herring (3.2.3, 3.2.5), mackerel (3.2.10), white hake (spawning ground-3.2.12), bluefin tuna (3.2.14), lobster (3.3.1), oyster (3.4.4), quahog (3.4.5), grey seal (3.5.1), Pictou Harbour (3.6.1), St. Georges Bay (3.6.3), and Basin Head (3.6.7).
- White hake is also associated with the following significant habitats: St. Georges Bay (3.2.12).

References

W2: T. Hurlbut, p.c. 2000
W4: DFO (white hake), 2001b
W5: Poirier et al., 2000
W6: Hurlbut et al., 1990
W9: NAFO, 2000


3.2.13 : White hake
nursery in Southern Gulf
GULF OF ST. LAWRENCE
Cavendish
East Point
Gaspereaux
Northumberland Strait
Pictou Island
Ingonish
PEI

F2

3.2.14 Bluefin tuna feeding ground around P.E.I. and western N.S.

Ecological Features

- Feeding habitat for bluefin tuna are located around P.E.I. and western N.S. [11, 15] (figure 3.2.14). Habitat boundaries are not well defined and may vary annually depending on the distribution of the prey. The boundaries presented are based on the commercial catches between 1998 and 2000. [11,12] They are the main feeding sites in the Southern Gulf, but other smaller areas may also be used by the species. [11-15]
- According to data gathered between 1981 and 1999, bluefin tuna abundance has slightly increased since 1997 in the Southern Gulf of St. Lawrence. But it may only depend on extrinsic environmental causes, like the presence of small (<230 cm FL) fish in 1999 that may be related to warmer summer water temperature in coastal waters. [11] Therefore, these recent increases in catches are not considered a reflection of a trend in stock abundance. [11]
- It is usually the bigger specimen that is caught in the Southern Gulf, with the average length being smaller off southwestern Nova Scotia. [11]
- The bluefin tuna commercial fishery, associated with the feeding migration, usually occurs from August to October, but it may extend from June to November on some years. [11,15] The tuna migrates off the tip of Cape Breton to feed in the Southern Gulf. They could have also migrated through the Canso canal before the Causeway was built. However, the main path was off Cape Breton, and the bigger specimens were using the Cape Breton path prior to the Canso Causeway project. [17]
- The Gulf of St. Lawrence is near the northern limit (Virgin Rocks, northeast of NFLD) of the West Atlantic species distribution. [11] The geographical distribution of the species is relatively worldwide, including the subtropical and temperate waters of the northern portion of both Atlantic and Pacific Oceans. [16] The species has wide migrations associated with feeding and reproduction (Gulf of Mexico). The bigger fish migrate further than the smaller ones and concentrate in areas at the limit of their distribution. [16]
- The major prey of bluefin tuna are squid, mackerel, and herring, followed by cod, white hake and capelin. [16]

Vulnerability, threats and human pressure

- The species is particularly popular in Japan where most of the world catches are sold. [16] This species is used in sushi and sashimi meals that are gaining popularity around the world.
- Bluefin tuna is highly migratory and its distribution range covers several oceans, making management difficult. Therefore, to assure success of

conservation efforts on stock size and health, member or non-member nations of the International Commission for the Conservation of Atlantic Tuna (ICCAT) have to follow the scientific-based advice.

- *« The oldest age considered reliable is 20 years, based on an estimated age at tagging of 2 years and about 18 years at liberty, although it is believed that bluefin tuna may live to older ages. Bluefin tuna are, thus, characterized by a late age at maturity (thus, a large number of juvenile classes) and a long life span, which make it well adapted to variations in recruitment success, but more vulnerable to fishing pressure than rapid growth species such as tropical tuna species.»* [8]
- Satellite tagging programs indicate that the East and West Atlantic stocks may be mixing (there is a great deal of uncertainty over this evidence). However, fishing pressures on both the East and West Atlantic stock may have to be considered for complete management of the stock.
- Recent catches have been higher than the ICCAT recommended TAC of 2500t (1998-2652t, 1999-2771t). These levels include dead discard figures that are released catch, dead or alive, for multiple reasons including not within the size limits.

Socio-economic characteristics

- Bluefin tuna is a commercially harvested species of high economic interest in the Southern Gulf of St. Lawrence. Commercial harvest has developed recently relative to traditional fisheries (groundfish, mackerel, herring, and lobster). The ICCAT manages the allocation of tunas in the Atlantic and Mediterranean, and sets quotas by country (Canada, U.S., Japan, Bermuda (U.K.) and St. Pierre et Miquelon (Fr.)) for the western Atlantic bluefin stock.
- NAFO Division 4T (see map in appendix) landings [9] for bluefin tuna: (1975) 237, (1980) 323t, (1985) 106t, (1990) 9t, (1995) 176t, and (1999) 164t.
- Landings occur predominately in statistical districts 87, 88, 92 (P.E.I.), and 3 and 13 (N.S.) (see map in appendix).

	10 year means (1990-99)		1999 landings	
	(metric tonnes)	($000)	(metric tonnes)	($000)
District 3	35	987	37	909
District 13	36	865	51	870
District 87	5	80	28	408
District 88	8	162	16	277
District 92	12	150	32	337
All districts Gulf N.S. and P.E.I.	92	2,158	164	2,801
Entire Gulf	92	2,158	164	2,801

- The tuna fishery is predominately an inshore vessel fishery. The season usually runs from late July to November, even if the effort may be more concentrated from August to October. Japan is the major market for bluefin tuna. There have been dramatic price fluctuations in this market over the years. The given market strength and the individual landed value of a bluefin tuna will be influence by the landed value fluctuations that may occur on a year to year basis. The price of each tuna caught is dependent on strict quality guidelines that are assessed at the wharf by Japanese buyers.
- There are other important commercial species, besides tuna, that are landed in statistical districts 87 and 88. These species are (1999 landed value order over $100,000):

Species	Value ($000)	Licenses (valid)	Season
Lobster (LFA 26A)	34,755	577	May 1- June 30
Mussels	6,695	32	Summer (wild)
Herring	2,122	278	Aug.-Sept.
Cod (3PN, 4R, 4T, 4S, 4VN)	764	416	Varies
Snow Crab	546	4	July- Sept.
Rock Crab (LFA 26A)	402	15	Aug. 9-Nov 9. (1999)
Softshell Clam	387	286	Summer
Silverside	359	27	
American Plaice (3PN, 4R, 4T, 4S, 4VN)	330	416	Varies
Mackerel	277	573	May – Aug.

- For districts 3 and 13, these species are (1999 landed value order over $100,000):

Species	Value ($000)	Licenses (valid)	Season
Lobster (LFA 26 A & B)	13,700	268	May 1-June 30
Snow Crab (Area 18 & 19)	1,544	35	July- Sept.
American Plaice (3PN, 4R, 4T, 4S, 4VN)	228	162 (unspecified groundfish)	Varies
Winter Flounder (3PN, 4R, 4T, 4S, 4VN)	161	162 (unspecified groundfish)	Varies
White Hake	151	162 (unspecified groundfish)	Closed (By-catch & Sentinel only)

- For district 92, these species are (1999 landed value order over $100,000):

Species	Value ($000)	Licenses (valid)	Season
Lobster (LFA 24)	16,811	272	May 1- June 30
Snow Crab (Area 12)	3,495	16	July- Sept.
Herring	1,175	228	Aug.- Sept.
Cod (3PN, 4R, 4T, 4S, 4VN)	730	198 (unspecified groundfish)	Varies
Irish Moss	293	112	Summer
Oyster	263	200	Apr. 15- July 15 (relay) Sept. 15- Nov. 15 (open)
Softshell Cla[illegible]	254	161	Summer

- The sport fishery for tuna and the tuna cup events were major tourism attractions. But, with the development of the commercial tuna fishery, this economic component have been overtaken by other activities.

Support, favourable and unfavourable factors

- Tuna fishers see the value of having a long-term science based management plan.
- The 2001 tuna management plan includes a satellite tagging project.
- Opportunity for co-operative effort between DFO science and tuna industry.
- Feeding grounds provide a basis for ecosystem-based management approach.
- Once ratified, the UN Convention on the Conservation And Management Of Straddling Fish Stocks And Highly Migratory Fish Stocks will instruct countries that share the management of the bluefin tuna to adopt measures to ensure the long-term sustainability of this stock and implement and enforce conservation and management measures through effective monitoring, control and surveillance

Other associated significant habitats

- The area around P.E.I. and western N.S. is a significant habitat included in fact sheets or appendix for: cod (3.2.2), herring (3.2.4, 3.2.5, 3.2.7-3.2.9), mackerel (3.2.10, 3.2.11), white hake (3.2.12, 3.2.13), scallop (3.4.7), grey seal (3.5.1), hooded seal (3.5.2), harp seal (3.5.3), St. Georges Bay (3.6.3), Cape Breton Trough (3.6.5), Fisherman's Bank (3.6.6), as well as grey seal (in appendix).
- Bluefin tuna is not associated with other significant habitat in this report.

References

T1: Stone et al., 2001

T2: B. MacInnis, p.c., 2001

T3: D. Cairns, p.c., 2001

T4: J. Jenkins, p.c., 2001

T5: G. Chouinard, p.c., 2001

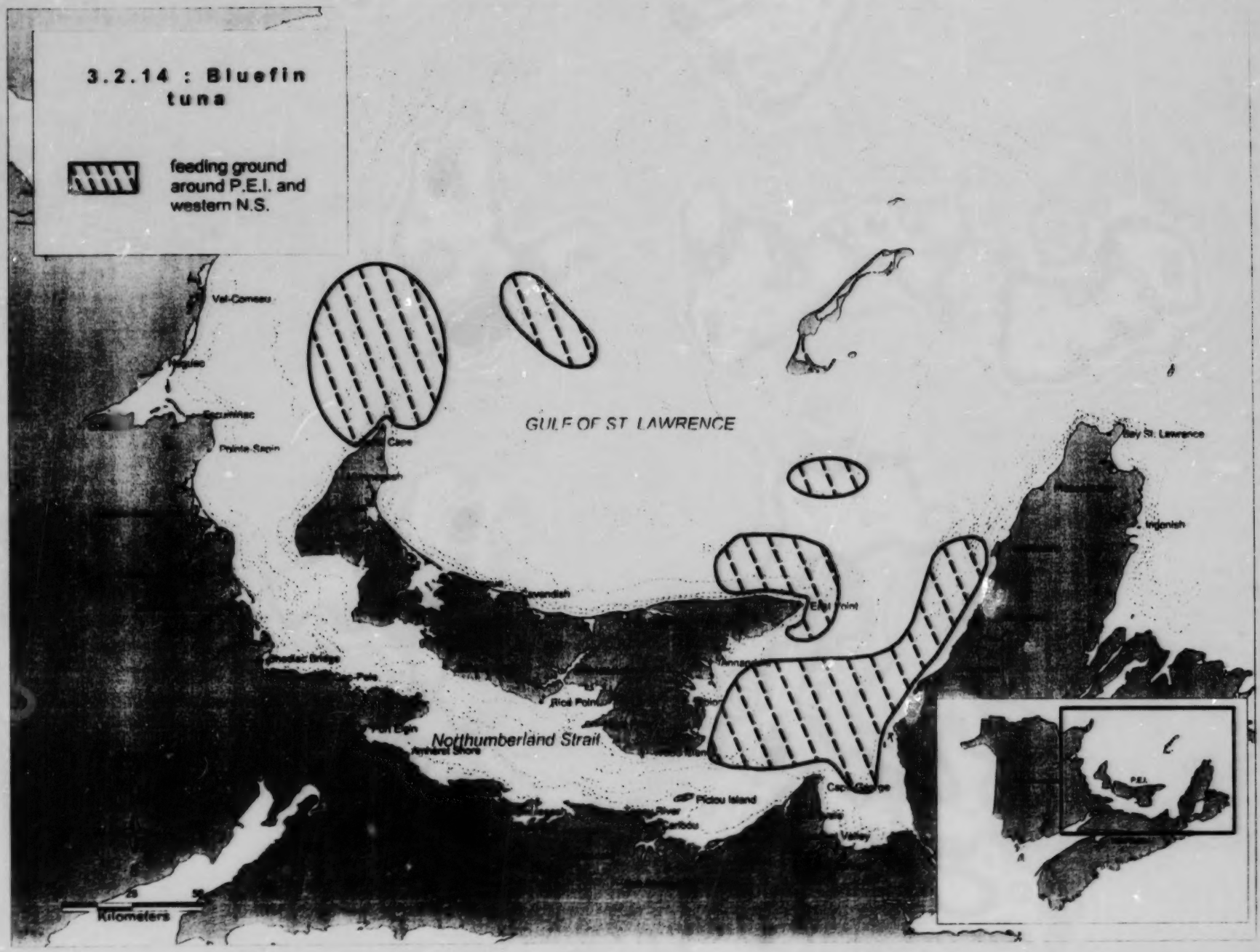
T6: Clay and Hurlbut, 1988

T7: H. Stone, p.c., 2001

T8: ICCAT, 2000

T9: NAFO, 2000

T10: DFO (Stats div), 2001


3.2.14 : Bluefin tuna
feeding ground around P.E.I. and western N.S.
GULF OF ST. LAWRENCE
Val-Comeau
Pointe-Sapin
Cape
Bay St. Lawrence
Inglenish
Rice Point
Northumberland Strait
Pictou Island
P.E.I.
25
0
Kilometers

3.3.1 Large-sized American lobster and berried female concentration between Egmont Bay and Wood Islands

Ecological Features

- Concentrations of large sized American lobster and berried females are located in the Northumberland Strait between Egmont Bay and Wood Islands [11-15] (figure 3.3.1). This area is an extension of an area presented for the same purpose in a previous report for the northeast region of New-Brunswick. [12]
- One of the two main habitats known for their high concentration of large-sized lobster in the Southern Gulf, the other being in the Chaleurs Bay. [11-15] This area is also known for a concentration of berried females. [11-14]
- Even thought all coastal areas around P.E.I. and N.S. support substantial lobster populations, this area is highlighted because of the presence of large sized specimen and berried female. Adults can be harvested almost everywhere during the fishing season since lobster spawning is ubiquitous to most inshore areas and all types of substrate can be used by the species. Sandy bottoms covered with algae are mostly used by juveniles, while rocky bottoms are used by adults.
- The Northumberland Strait is a highly productive area as shown by several fact sheets (3.1.1, 3.2.3, 3.2.4, 3.2.12 - 3.2.14, 3.3.1, 3.4.7, and 3.5.1) and appendices (3.2.16, 3,3,3, 3.3.4, 3.4.8, and 3.5.4). Current gyres border each end of the Strait. High productivity is associated with these gyres because they concentrate the nutrients and the plankton, and attract species at higher trophic levels. The recurrent high catches of several species such as the rock crab, lobster, herring, and mackerel also show that the Northumberland Strait is a highly productive area. Details about Pictou Harbour and Pictou Island productivity can be gathered in other fact sheets (3.6.1 and 3.6.2).

Vulnerability, threats and human pressure

- There is an over exploitation of recruits and shortage of egg production. [8]
- In 1995, the Fisheries Resource Conservation Council (FRCC) concluded that lobster fishing was currently conducted at high exploitation rates on immature lobsters and did not allow adequate egg production. [17]
- Maintenance of adequate bottom could be jeopardised off Cape Tormentine because of a concentration of sea scallop in this area [11,12] along with a sea scallop spat harvesting area [11,13] that is in use. Dredging rough bottoms can have a serious adverse impact on lobster, with the proportion of captured and injured specimens reaching up to 12%. [8,9]

- There are numerous scallop drags fishing in the area.
- Measures taken to protect this resource have helped to improve the situation, i.e. adding a biodegradable panel (1993) and a rectangular escape mechanism for sub-legal size lobsters (1995).
- There are several fishing wharves in this area.

Socio-economic characteristics

- Lobster is the most important component of the inshore fishery in the Southern Gulf of St. Lawrence. Most fishers designated "*bonafidae*" hold a lobster license. In the Southern Gulf Region there are 3309 registered lobster licenses. The fishery has been important since the late 19th century and now dominates the landed value in several regions of Atlantic Canada (Maritimes and Gulf). Over the years lobster fishing became, and remains, an important factor in the social and economic development of Atlantic coastal communities and in particular those of the Southern Gulf of St. Lawrence. [n0]
- NAFO Division 4T (see map in appendix) landings [n1] for lobster: (1975) 8,872t, (1980) 10,770t, (1985) 15,935t, (1990) 22,118t, (1995) 18,174t, and (1999) 16,733t.
- Landings for this fact sheet cover a significant portion of the central Northumberland Strait area and would predominately appear in the landings data of statistical districts 83, 85, and 86 (P.E.I.); district 80 (N.B.) (see map in appendix); districts 10,11,12, 45, and 46 (N.S.). Lobster licenses held in districts 83, 85 and 86 are 108; 108 for district 80, 77 for district 45, 46, and 10; and 175 for districts 11 and 12.

	10 year means (1990-99)		1999 landings	
	(metric tonnes)	($000)	(metric tonnes)	($000)
District 10,45,46	315	2,601	317	3,776
District 11,12	816	6,567	763	9,010
District 83,85,86	518	4,054	383	4,593
District 80 (N.B.)	374	2,765	245	2,943
All districts Gulf N.S. and P.E.I.	12,105	90,359	11,005	120,186
Entire Gulf	18,816	137,670	16,733	181,362

- The lobster fishery is considered a core fishery. The lobster fishery is carried out with vessels under 45 feet. Lobster fishers may often participate in a combination of fisheries (herring, scallop, rock and snow crab, groundfish, and tuna) and usually do not participate in "coastal" fisheries (oyster, quahog, soft-shell and surf clams, smelts, marine plants, and eels). Limited

entry licensing was introduced to the lobster fishery in 1969 and the number of licenses was frozen in 1976. New entrants to the fishery must purchase an existing license and must have a minimum of two years registered helper certification to hold the license.

- It is not uncommon, in most areas, that informal tenure agreements occur. Access to the lobster grounds is established at the wharves by the fishers. Lobster grounds are often intergenerational in a family and informal enforcement of access is organised around the homeport.
- One of the problems perceived in the lobster fishing industry is the shared responsibility between two government levels: fishing (licenses, management) is under federal jurisdiction, while lobster processing plants come under provincial responsibility. The lack of collaboration between these two regulatory bodies can indirectly have negative consequences on the fishing effort or on the fishers by creating economic expectations that do not match the stock status.
- The location of the site overlaps with two lobster fishing areas (LFA - see map in appendix). LFA 26A which is located at the eastern end of Northumberland Strait (Season May 1-June 30) and LFA 25 which is located in the western section of Northumberland Strait (Season August 9-October 9, 1999 season).
- Since 1990, there has been a reduction in landed weight of lobster in most districts. An upward or stabilised trend has been witnessed in the last three years of the decade. 1990 marked the recent high point in landed weight. The landed value of lobster has risen steadily in the 1990's. The average price per lbs. in 1990 was $1.47 for canner sized lobster and $2.28 for market sized lobster. In 1999 price average was $4.55 for canner lobster and $5.70 for market lobster. This increase has allowed landed value to rise while landed weight declined.
- There are four First Nation reserves located within the boundaries of the study area. They are Lennox Island (district 92), Abegweit (district 88), Pictou Landing (district 12), and Afton (district 13). Since the Marshall decision of the Supreme Court of Canada in September 1999, First Nation's leaders and DFO managers have been looking for solutions that will allow First Nation Bands to participate in commercial fisheries. Access to lobster has been one of the major areas of discussion. Following that court decision, Fisheries and Oceans Canada has implemented a buy-back program to provide additional access for the aboriginal people.[12] Afton received 3 licenses in LFA 26A, Pictou Landing received 8 licenses in LFA 26A, Lennox Island 2 licenses in LFA 25, and Abegweit 2 licenses in LFA 26A. This process is ongoing and will change over time.

- There are other important commercial species, besides lobster, that are landed in statistical districts 83, 85 and 86. These species are (1999 landed value order over $100,000):

Species	Value ($000)	Licenses (valid)	Season
Oyster	6,212	995	Apr. 15- July 15 (relay) Sept. 15- Nov. 15 (open)
Quahog	1,727	762	Summer
Rock Crab	925	28	Aug.16 – Nov. 13 (1999)
Herring	432	75	Aug.- Sept.
Scallop	420	48	Oct.- Nov. (Varies)
Softshell Clam	413	762	Summer
Smelt	136	58	Sept.- March
Bar Clam	123	766	Summer

- For districts 10, 45 and 46, these species are (1999 landed value order over $100,000):

Species	Value ($000)	Licenses (valid)	Season
Oyster	795	129	Sept.- Oct.
Quahog	360	102	Summer
Rock Crab	88	9	Aug. 16- Nov 13. (1999)

- For districts 11 and 12, these species are (1999 landed value order over $100,000):

Species	Value ($000)	Licenses (valid)	Season
Herring	1,259	166	Aug.- Sept.
Scallop	467	78	Oct.-Dec. (Varies)
Rock Crab	398	30	Aug. 16- Nov 13. (1999)
Mussel	100	22	Summer (wild) Year round (aquaculture)

Support, favourable and unfavourable factors

- DFO's scientific advice calls for an increase in lobster egg production; this is supported by the FRCC. [8]
- The protection of certain inshore habitats can contribute to maintaining the diversity of ecosystems and the geographical particularities of lobster populations. Maintaining and protecting these biological features could be the basis of a sustainable development of the lobster industry. This approach

has the support of fishers in certain Southern Gulf of St. Lawrence communities.

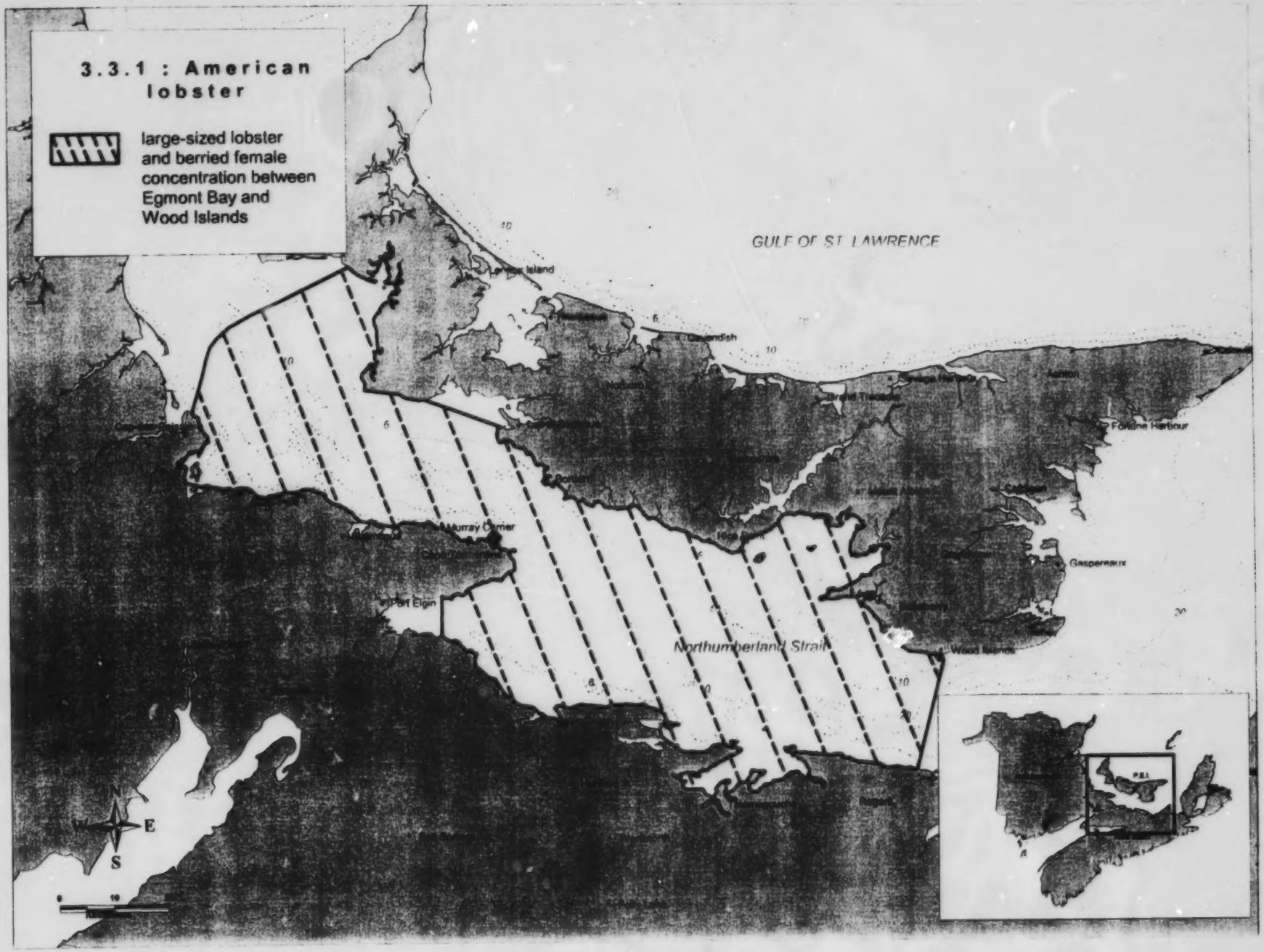
- DFO is currently conducting a study on lobster lavae distribution in the Northumberland Strait and Southern Gulf area. The study is expected to be completed in 2002 and data should help refine the location of significant habitats for lobster.
- There is the possibility of a partnership with the Canadian Wildlife Service, which has interests in the area. This site is a good habitat for migrating shorebirds and waterfowl.
- A natural park and a national wildlife reserve were established in 1996 in nearby Cape Jourimain.
- This site covers an area with multiple provincial jurisdictions.
- Current conservation management measures include a closed season, protection of berried females, and a scallop dragging exclusion zone.

Other associated significant habitats

- The Egmont Bay to Wood Islands area is significant habitat included in fact sheets or appendices for: Irish moss (3.1.2), herring (3.2.3, 3.2.5 and 3.2.8), white hake (3.2.13), oyster (3.4.1), quahog (3.4.5, and 3.4.6), scallop (3.4.7), grey seal (3.5.1), and also herring, rock crab, surf clam, soft-shell clam, grey seal and harbour seal (see appendix).
- Lobster is associated with the following significant habitat: Malpeque Bay (see appendix).

References

L1: MacNeil, J.L. & Assoc., 1998
L2: Therrien et al., 2000
L3: M. Lanteigne, p.c., 2001
L4: B. MacInnis, p.c., 2001
L5: Hanson, 2001
L6: Lanteigne et al., 1998
L7: FRCC, 1995
L8: Jamieson et al., 1981
L9: Scarrat, 1975
L10: DFO (lobster), 1998b
L11: NAFO, 2000
L12: DFO (lobster profile), 2000a


3.3.1 : American lobster
large-sized lobster and berried female concentration between Egmont Bay and Wood Islands
GULF OF ST. LAWRENCE
Northumberland Strait
Murray Harbour
Port Elgin
Gaspereaux
Fortune Harbour
PEI
N
E
S

3.4.1 American oyster high concentration in Tatamagouche Bay

Ecological Features

- Major beds along with major spat collection site in Tatamagouche Bay (N.S.) [01,02] (figure 3.4.1). It is the main site of production and collection on the Gulf coast of Nova-Scotia, from Baie Verte to Cape St. Lawrence. A secondary site is located at Caribou Harbour. [01,03]
- The resource is generally at a depth of 3 fathoms (5 m) or less [04], but it can reach up to 12.5 fathoms (20 m). [04]
- Even if the bay is productive for oyster, the concentration of spat is light in the area. [04]
- The bay is a productive area notably for mussel, soft-shell clam and quahog. [01,03]
- The Southern Gulf of St. Lawrence is the northern limit of the West Atlantic species distribution. [05]

Vulnerability, threats and human pressure

- Being at its West Atlantic northern limit, the species is therefore more sensitive to overexploitation. Recolonisation may be more difficult if a major decline should occur.
- The oyster spat collection rate varies widely because of diverse environmental factors that could influence the movement and settlement of larvae, such as currents, wind, turbidity and water temperature.
- The wild stock is subject to public harvesting.
- The area is used for the depuration of oysters.
- Malpeque disease decimated the stocks on P.E.I. (1915-39) and later (1950-1960) in the rest of the Southern Gulf. Only the resistant strains from P.E.I. allowed the recolonisation of all the coastal areas. [05]
- Bivalve molluscs are subject to contamination from natural and anthropogenic causes. Natural causes include Paralytic Shellfish Poisoning (PSP) toxins (saxotoxin/neosaxitoxin), Amnesic Shellfish Poisoning (ASP) toxins (domoic acid), and Diarrhetic Shellfish Poisoning (DSP) toxins (okadaic acid and about ten other associated toxins) as well as faecal coliform associated with natural gathering of wild animals, such as geese and cormorans. Anthropogenic contamination is mainly associated with faecal coliform and E. coli bacteria resulting from human or animal waste contamination.
- Shellfish contamination is associated with the following contributing factors: treated and untreated municipal sewage discharges; land wash from agricultural and urban areas; seepage from poorly operating septic tank and

tile field disposal systems; direct discharges of raw sewage from moored or anchored boats and from shore-side residences; treated and untreated industrial wastes; wildlife and domestic animals.

- A study has showed some organotin (TBT) contamination in estuaries of the Southern Gulf. Antifouling paint containing TBT have been banned for use on most vessels. Organotins can be resuspended in the water column when sediments are disturbed, or when boat hulls are cleaned near the water. Organotins are highly toxic to shellfish larvae. High levels of organotin are still present in harbours with larger vessel traffic. [67]
- The area is a waterfowl staging area during the fall season. Some of these species can prey on oysters.

Socio-economic characteristics

- American oyster is a commercially harvested species of economic interest to the Gulf N.S. fishery. Other than the Bras d'Or Lakes in Cape Breton, Tatamagouche Bay and Wallace Harbour are the major areas of commercial oyster harvesting in N.S.
- Enhancement of the oyster fishery began in 1972; the program was referred to as Oyster Development Program (ODP), and this was administered by DFO until 1994 when the Provincial Department of Fisheries took over the administration of ODP.
- NAFO Division 4T (see map in appendix) landings [68] for oyster: (1975) 1,616t, (1980) 1,442t, (1985) 2,060t, (1990) 2,637t, (1995) 2,204t, and (1999) 3,397t.
- Licenses for oyster are held predominately in statistical districts 10, 11, 16, 45, 46, 49, 51 and 62, for a total of 208 licences held in Gulf in N.S. (see map in appendix); landings [69] occur predominately in districts 10, 45, and 46. Oyster licenses held in district 10 are 16, 49 for district 11,51 for district 45 , and 62 for district 46. Oyster licenses for all Gulf N.S. districts are 208.

	10 year means (1990-99)		1999 landings	
	(metric tonnes)	($000)	(metric tonnes)	($000)
District 10	8	17	19	56
District 45	48	99	216	530
District 46	45	96	83	209
All districts Gulf N.S. and P.E.I.	1,797	3,511	3,088	6,741
Entire Gulf	2,311	4,684	3,225	7,173

- The traditional oyster fishery is considered a coastal fishery (along with quahog, surf clam, soft-shell clam, marine plants, smelt, silverside, and eel

fisheries). Limited entry licensing was introduced to the P.E.I. oyster fishery in 1987.

- Apart from the current management tools (season and size), few attempts have been made to try to find ways to manage oyster fishing in public areas. This is basically because of the lack of information on the stock status, an effective monitoring protection and control program for landings and statistics gathering system that would identify the location of the fishing effort. [66]
- An important ostreiculture industry is developing throughout the Southern gulf of St. Lawrence.
- There are other important commercial species, besides oyster, that are harvested in statistical districts 10, 45, and 46. These species are (1999 landed value order over $50,000):

Species	Value ($000)	Licenses (valid)	Season
Lobster (LFA 25 & 26A)	3,504	77	May 1- June 30 (LFA 26A) Aug. 9- Oct. 9 (1999 LFA 25)
Quahog	360	102	Summer
Rock Crab	88	9	Aug. 16- Nov 13. (1999)

Support, favourable and unfavourable factors

- The Regional Aquaculture Development Advisory Committee (RADAC) is a provincial advisory committee that is doing aquaculture management in that area.
- The people that reside around this bay were recently successful in blocking an application to lease a portion of the bay for intensive mussel aquaculture development.
- In response to the perceived intrusion of the proposed mussel farm, basic studies of the bay have been completed. These include environmental impact, navigation in the bay, tourism, socio-economic, habitat and ecology of the bay.
- Fishers and aquaculture operators could approve the protection of this habitat because they are concerned about the state of the resource.

Other associated significant habitats

- Tatamagouche Bay is a significant habitat included in fact sheets or appendix for: lobster (3.3.1), grey seal (3.5.1), and also spring-spawning herring (see appendix).
- Oyster is associated with the following significant habitats: the three rivers near Charlottetown (3.4.2), Bedeque Bay (3.4.3), and Malpeque Bay (3.4.4).

References

O1: Jenkins et al., 1997

O2: D. Austin and B. Scallion, p.c., 2001

O3: MacNeil, J.L. & Assoc., 2001

O4: T. Landry, p.c., 2001

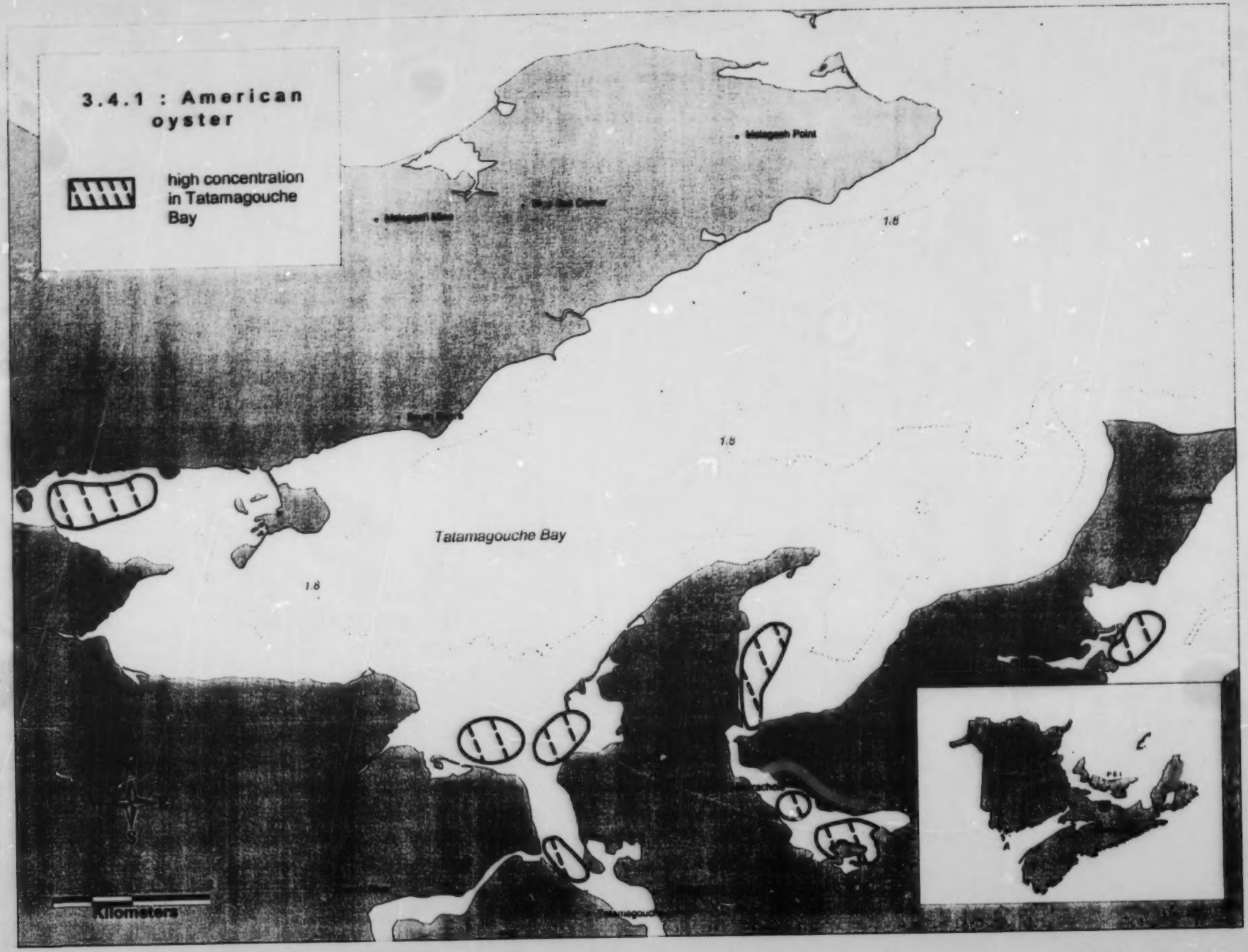
O5 : DFO (oyster), 1996c

O6 : L.-A. Davidson, p.c., 2001

O7: St-Jean et al., 1999

O8: NAFO, 2000

O9: DFO (Stats. Div.), data


3.4.1 : American oyster
high concentration in Tatamagouche Bay
Malagash Point
1.8
1.8
Tatamagouche Bay
1.8
Kilometers

3.4.2 American oyster high concentration in the three rivers near Charlottetown

Ecological Features

- Major natural oyster beds, high concentration of oyster spat and spat collection site in the West, North and Hillsborough (East) rivers near Charlottetown (P.E.I.) [01,04,05,010,011] (figure 3.4.2). The downstream boundary roughly consists of the mouth of the main river and the limit between approved and closed areas for harvesting.
- In P.E.I., the main oyster production area is Bedeque Bay (fact sheet 3.4.3), but the three rivers near Charlottetown, particularly West River, are also considered major areas. Malpeque Bay (fact sheet 3.4.4) is also another major area for oyster production.
- The resource is generally at a depth of 1.5 fathom (2.5 m) or less [012], but it can reach up to 12.5 fathoms (20 m). [05]
- The three rivers are productive areas, notably for quahog (fact sheet 3.4.5), blueback herring, eel, and smelt. [03,013] Some oyster aquaculture leases are located in the upper part of Hillsborough River and in the median part of West River. [014]
- The Southern Gulf of St. Lawrence is the northern limit of the West Atlantic species distribution. [05]

Vulnerability, threats and human pressure

- Being at its West Atlantic northern limit, the species is therefore more sensitive to overexploitation. Recolonisation may be more difficult if a major decline should occur.
- The spat collection rate varies widely because of diverse environmental factors that could influence the movement and settlement of larvae, such as currents, wind, turbidity and water temperature.
- The wild stock is subject to public harvesting
- Malpeque disease decimated the stocks on P.E.I. (1915-39) and later (1950-1960) in the rest of the Southern Gulf. Only the resistant strains from P.E.I. allowed the recolonisation of all the coastal areas. [05]
- Bivalve molluscs are subject to contamination from natural and anthropogenic causes. Natural causes include Paralytic Shellfish Poisoning (PSP) toxins (saxotoxin/neosaxitoxin), Amnesic Shellfish Poisoning (ASP) toxins (domoic acid), and Diarrhetic Shellfish Poisoning (DSP) toxins (okadaic acid and about ten other associated toxins) as well as faecal coliform associated with natural gathering of wild animals, such as geese and cormorans. Anthropogenic contamination is mainly associated with

faecal coliform and E. coli bacteria resulting from human or animal waste contamination.

- Shellfish contamination is associated with the following contributing factors: treated and untreated municipal sewage discharges; land wash from agricultural and urban areas; seepage from poorly operating septic tank and tile field disposal systems; direct discharges of raw sewage from moored or anchored boats and from shore-side residences; treated and untreated industrial wastes; wildlife and domestic animals.
- *«Nutrient enrichment of P.E.I. estuarine environments is a growing problem, and too often has implications for dissolved oxygen levels as well. While much of the attention has been given to the role of nitrogen in the development of eutrophic conditions in Island estuaries, there is evidence that phosphorous levels may also be significant, perhaps even limiting factors in many of these cases.»* [015]
- A study has showed some organotin (TBT) contamination in the Summerside area, as well as in other estuaries of the Southern Gulf. Antifouling paint containing TBT have been banned for use on most vessels. Organotins can be resuspended in the water column when sediments are disturbed, or when boat hulls are cleaned near the water. Organotins are highly toxic to shellfish larvae. High levels of organotin are still present in harbours with larger vessel traffic. [67]

Socio-economic characteristics

- Oyster harvest is of high economic importance to the P.E.I. fishery. The commercial oyster fishery has been carried out on P.E.I. since the mid 19th century. Oyster landings ranked third in landed value for P.E.I. in 1999.
- Enhancement of the oyster fishery began in 1972, the program was referred to as Oyster Development Program (ODP), and this was administered by DFO until 1994 when the Provincial Department of Fisheries took over administration of ODP.
- NAFO Division 4T (see map in appendix) landings [68] for oyster: (1975) 1,616t, (1980) 1,442t, (1985) 2,060t, (1990) 2,637t, (1995) 2,204t, and (1999) 3,397t.
- Oyster landings [69] occur predominately in statistical districts 85 and 86 in P.E.I. (see map in appendix). Oyster licenses held in districts 85 and 86 are 89 (spring relay), and 114 (fall open). Oyster licenses province wide are 906 (spring relay), and 1,042 (fall open).

	10 year means (1990-99)		1999 landings	
	(metric tonnes)	($000)	(metric tonnes)	($000)
District 85	260	525	783	1,609
District 86	783	464	239	456
All districts	1,797	3,511	3,088	6,741
Gulf N.S. and P.E.I.				
Entire Gulf	2,311	4,684	3,225	7,173

- The oyster fishery operates in two seasons, a spring "relay" fishery, and a fall "open" season. The relay fishery involves harvesting on grounds designated contaminated. The harvest is relayed to non-contaminated water for depuration. The relay fishery is open from April 15-July 15. The "open" season takes place from September 15-November 15.
- The oyster fishery is considered a coastal fishery (along with quahog, surf clam, soft-shell clam, marine plants, smelt, silverside, and eel fisheries). Limited entry licensing was introduced to the P.E.I. oyster fishery in 1987.
- Apart from the current management tools (season and size), few attempts have been made to try to find ways to control oyster fishing in public areas. This is basically because of the lack of information on the stock status, an effective monitoring protection and control program for landings and statistics gathering system that would identify the location of the fishing effort. [66]
- An important ostreiculture industry is developing throughout the Southern Gulf of St. Lawrence.
- There are other important commercial species, besides oyster, that are harvested in statistical districts 85 and 86. These species are (1999 landed value order over $100,000):

Species	Value ($000)	Licenses (valid)	Season
Lobster (LFA 26A)	2,280	48	May 1- June 30
Quahog	1,149	251	Summer
Rock Crab	779	26	Aug. 16- Nov 13. (1999)
Scallop	334	26	Oct.- Dec. (Varies)
Softshell Clam	255	250	Summer
Bar Clam	119	254	Summer

Support, favourable and unfavourable factors

- This site would benefit from Marine Environmental Quality (MEQ) standards, since water quality is of critical importance for the shellfish industry. The MEQ program would support an Integrated Management (IM) effort.
- Charlottetown is under pressure to begin efforts to clean up the harbour.
- Fishers and aquaculture operators could approve the protection of this habitat because they are concerned about the state of the resource.
- American oyster and quahog could be threatened due to human activity.

Other associated significant habitats

- The three rivers near Charlottetown are significant habitats included in fact sheets for: quahog (3.4.5), and grey seal (3.5.1).
- Oyster is associated with the following significant habitats: Tatamagouche Bay (3.4.1), Bedeque Bay (3.4.3), and Malpeque Bay (3.4.4).

References

O1: Jenkins et al., 1997

O3: MacNeil, J.L. & Assoc., 2001

O4: T. Landry, p.c., 2001

O5 : DFO (oyster), 1996c

O7: St-Jean et al., 1999

O8: NAFO, 2000

O9: DFO (Stats. Div.), data

O10: M. Smith, p.c., 2001

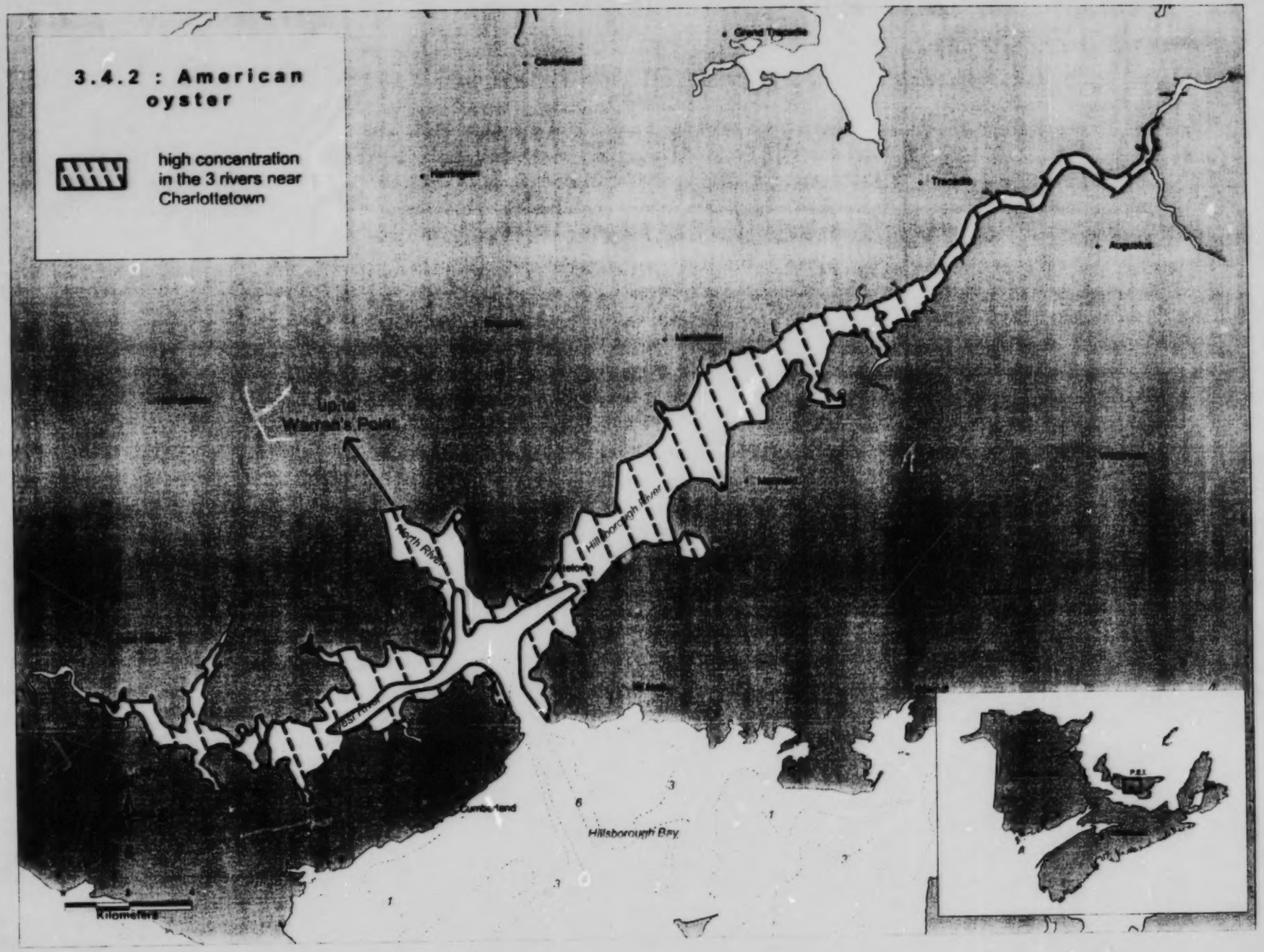
O11: J. Jenkins, p.c., 2001

O12: L. Murphy, p.c., 1852

O13: Cairns, 1997

O14: DFO, unpublished aquaculture leases data, 2001

O15: Somers et al., 1999, p.53


3.4.2 : American oyster
high concentration in the 3 rivers near Charlottetown
Grand Tracadie
Cleveland
Tracadie
Augustus
Upton
Warren's Point
North River
Hillsborough River
West River
Hillsborough Bay
Kilometers
PEI

3.4.3 American oyster high concentration in Bedeque Bay

Ecological Features

- Major natural oyster beds, high concentration of oyster spat and spat collection sites in Bedeque Bay (P.E.I.) [01,04,05,010,011] (figure 3.4.3). The bed locations have been stable over the years, with the same general area being identified in the 70's.[016]
- Bedeque Bay is the main oyster production area in P.E.I. Other major areas are the three rivers near Charlottetown (fact sheet 3.4.2), particularly West River, and Malpeque Bay (3.4.4).
- Bedeque Bay is also the main oyster spat production area in P.E.I. Spat from this area is being exported to other areas around P.E.I.
- The resource is generally at a depth of 1.5 fathoms (2.5 m) or less [012], it but can reach up to 12.5 fathoms (20 m). [06]
- The bay is also a productive area for other species, notably for surf clam, mussel, eel (growth), alewife, gaspereau, smelt and tomcod. [03,013]
- The Southern Gulf of St. Lawrence is the northern limit of the West Atlantic species distribution. [06]

Vulnerability, threats and human pressure

- Being at its West Atlantic northern limit, the species is therefore more sensitive to overexploitation. Recolonisation may be more difficult should a major decline occur.
- The spat collection rate varies widely because of diverse environmental factors that influence the movement and settlement of larvae, such as currents, wind, turbidity and water temperature.
- The wild stock is subject to public harvesting.
- Malpeque disease decimated the stocks on P.E.I. (1915-39) and later (1950-1960) in the rest of the Southern Gulf. Since then, disease-resistant oysters from the Ellerslie River in P.E.I. have been re-introduced throughout the maritimes. [06]
- All anthropogenic stresses: increasing sedimentation activities (forestry cut-offs, urbanisation, etc.), agricultural use of chemical (pesticides, fertilisers which lowered the biochemical oxygen demand-BOD, etc.), and industrial pollution (anoxia events, etc.).
- Bivalve molluscs are subject to contamination from natural and anthropogenic causes. Natural causes include Paralytic Shellfish Poisoning (PSP) toxins (saxotoxin/neosaxitoxin), Amnesic Shellfish Poisoning (ASP) toxins (domoic acid), and Diarrhetic Shellfish Poisoning (DSP) toxins (okadaic acid and about ten other associated toxins) as well as faecal

coliform associated with natural gathering of wild animals, such as geese and cormorans. Anthropogenic contamination is mainly associated with faecal coliform and E. coli bacteria resulting from human or animal waste contamination.

- Shellfish contamination is associated with the following contributing factors: treated and untreated municipal sewage discharges; land wash from agricultural and urban areas; seepage from poorly operating septic tank and tile field disposal systems; direct discharges of raw sewage from moored or anchored boats and from shore-side residences; treated and untreated industrial wastes; wildlife and domestic animals.
- *«Nutrient enrichment of P.E.I. estuarine environments is a growing problem, and too often has implications for dissolved oxygen levels as well. While much of the attention has been given to the role of nitrogen in the development of eutrophic conditions in Island estuaries, there is evidence that phosphorous levels may also be significant, perhaps even limiting factors in many of these cases.»* [65]
- A study has showed some organotin (TBT) contamination in estuaries of the Southern Gulf. Antifouling paint containing TBT have been banned for use on most vessels. Organotins can be resuspended in the water column when sediments are disturbed, or when boat hulls are cleaned near the water. Organotins are highly toxic to shellfish larvae. High levels of organotin are still present in harbours with larger vessel traffic. [67]

Socio-economic characteristics

- Oyster harvest is of high economic importance to the P.E.I. fishery. The commercial oyster fishery has been carried out on P.E.I. since the mid 19th century. Oyster landings ranked third in landed value for P.E.I. in 1999. Bedeque Bay is a major contributor to the Southern Gulf of St. Lawrence oyster fishery.
- Enhancement of the oyster fishery began in 1972. The program was referred to as Oyster Development Program (ODP), and this was administered by DFO until 1994 when the Provincial Department of Fisheries took over administration of ODP.
- NAFO Division 4T (see map in appendix) landings [68] for oyster: (1975) 1,616t, (1980) 1,442t, (1985) 2,060t, (1990) 2,637t, (1995) 2,204t, and (1999) 3,397t.
- Oyster landings [68] of occur predominately in statistical district 83 (see map in appendix). Oyster licenses held in district 83 are 421 (spring relay), and 371 (fall open). Oyster licenses province wide are 906 (spring relay), and 1,042 (fall open).

	10 year means (1990-99)		1999 landings	
	(metric tonnes)	($000)	(metric tonnes)	($000)
District 83	769	1,559	1,869	4,147
All districts	1,797	3,511	3,088	6,741
Gulf N.S. and P.E.I.				
Entire Gulf	2,311	4,684	3,225	7,173

- The oyster fishery operates in two seasons, a spring "relay" fishery, and a fall "open" season. The relay fishery involves harvesting on grounds designated contaminated. The harvest is relayed to non-contaminated water for depuration. The relay fishery is open from April 15-July 15. The "open" season takes place from September 15-November 15.
- The oyster fishery is considered a coastal fishery (along with quahog, surf clam, soft-shell clam, marine plants, smelt, silverside, and eel fisheries). Limited entry licensing was introduced to the P.E.I. oyster fishery in 1987.
- Apart from the current management tools (season and size), few attempts have been made to try to find ways to control oyster fishing in public areas. This is basically because of the lack of information on the stock status, an effective monitoring protection and control program for landings and statistics gathering system that would identify the location of the fishing effort. [85]
- There are other important commercial species, besides oyster, that are landed in statistical district 83. These species are (1999 landed value order over $100,000):

Species	Value ($000)	Licenses (valid)	Season
Lobster (LFA 25)	2,308	60	Aug. 9-Oct. 9 (1999)
Quahog	578	511	Summer
Herring	402	49	Aug. - Sept.
Softshell Clam	158	512	Summer
Rock Crab	146	2	May - June
Smelt	100	28	Sept.- March

Support, favourable and unfavourable factors

- This site would benefit from Marine Environmental Quality (MEQ) standards, since water quality is of critical importance for the shellfish industry. The MEQ program would support an Integrated Management (IM) effort.
- Bedeque Bay is an Environment Canada Atlantic Coastal Action Program (ACAP) site. The site is known as Bedeque Bay Environmental Management

Association (BBEMA) and involves the community in an approach to solving environmental problems.

- Adjacent to Summerside Harbour, and associated effects due to proximity to urban centre.
- Fishers and aquaculture operators could approve the protection of this habitat because they are concerned about the state of the resource.

Other associated significant habitats

- Bedeque Bay is a significant habitat included in appendix for: soft-shell clam.
- Oyster is associated with the following significant habitats: Tatamagouche Bay (3.4.1), the three rivers near Charlottetown (3.4.2), and Malpeque Bay (3.4.4).

References

O1: Jenkins et al., 1997
O3: MacNeil, J.L. & Assoc., 2001
O4: T. Landry, p.c., 2001
O5 : DFO (oyster), 1996c
O7: St-Jean et al., 1999
O8: NAFO, 2000
O9: DFO (Stats. Div.), data
O10: M. Smith, p.c., 2001
O11: J. Jenkins, p.c., 2001
O12: L. Murphy, p.c., 1852
O13: Cairns, 1997
O15: Somers et al., 1999, p.53
O16: Hawkins and Rowell, 1985abc

3.4.3 : American oyster
high concentration in Bedeque Bay
Summerside
Wilmot
Wilmot Valley
Bedeque Bay
N
W
E
S
Kilometers
PEI

3.4.4 American oyster high spat concentration in Malpeque Bay

Ecological Features

- Major concentration of oyster spat in Malpeque Bay (P.E.I.), more precisely in the bay next to Ellerslie [011,016] (figure 3.4.4).
- Malpeque Bay has traditionally been a productive area for oyster spat collection. The bay is also productive for commercial sized oyster, however, it is now considered a secondary collection area even though it was a major one historically. This is because it never regained its initial production level after the Malpeque disease. [01]
- In P.E.I. the main oyster production area is Bedeque Bay (fact sheet 3.4.3), but the three rivers near Charlottetown (fact sheet 3.4.2), particularly West River, are also considered major areas.
- Malpeque Bay is also a productive area for other species, notably for soft-shell clam (see appendix), surf clam, mussel, quahog, eel (growth), and smelt. [03]
- The Southern Gulf of St. Lawrence is the northern limit of the West Atlantic species distribution. [05]

Vulnerability, threats and human pressure

- Being at its West Atlantic northern limit, the species is more sensitive to overexploitation. Recolonisation may be more difficult should a major decline occur.
- The spat collection rate varies widely because of diverse environmental factors that influence the movement and settlement of larvae, such as currents, wind, turbidity and water temperature.
- The wild stock is subject to public harvesting.
- Malpeque disease decimated the stocks on P.E.I. (1915-39) and later (1950-1960) in the rest of the Southern Gulf. Since then disease-resistant oysters from the Ellerslie river in P.E.I. have been re-introduced throughout the maritimes. [05]
- All anthropogenic stresses: increasing sedimentation activities (forestry cut-offs, urbanisation, etc.), agricultural use of chemical (pesticides, fertilisers which lowered the biochemical oxygen demand-BOD, etc.), and industrial pollution (anoxia events, etc.).
- Bivalve molluscs are subject to contamination from natural and anthropogenic causes. Natural causes include Paralytic Shellfish Poisoning (PSP) toxins (saxotoxin/neosaxitoxin), Amnesic Shellfish Poisoning (ASP) toxins (domoic acid), and Diarrhetic Shellfish Poisoning (DSP) toxins (okadaic acid and about ten other associated toxins) as well as faecal

coliform associated with the natural gathering of wild animals, such as geese and cormorans. Anthropogenic contamination is mainly associated with faecal coliform and E. coli bacteria resulting from human or animal waste contamination.

- Shellfish contamination is associated with the following contributing factors: treated and untreated municipal sewage discharges; land wash from agricultural and urban areas; seepage from poorly operating septic tank and tile field disposal systems; direct discharges of raw sewage from moored or anchored boats and from shore-side residences; treated and untreated industrial wastes; wildlife and domestic animals.
- Malpeque Bay has recently witnessed the introduction of *Codium fragile*, a destructive form of algae that smothers oyster beds.
- *«Nutrient enrichment of P.E.I. estuarine environments is a growing problem, and too often has implications for dissolved oxygen levels as well. While much of the attention has been given to the role of nitrogen in the development of eutrophic conditions in Island estuaries, there is evidence that phosphorous levels may also be significant, perhaps even limiting factors in many of these cases.»* [65]
- A study has showed some organotin (TBT) contamination in estuaries of the Southern Gulf. Antifouling paint containing TBT have been banned for use on most vessels. Organotins can be resuspended in the water column when sediments are disturbed, or when boat hulls are cleaned near the water. Organotins are highly toxic to shellfish larvae. High levels of organotin are still present in harbours with larger vessel traffic. [67]

Socio-economic characteristics

- Oyster harvest is of high economic importance to the P.E.I. fishery. The commercial oyster fishery has been carried out on P.E.I. since the mid 19th century. Oyster landings ranked third in landed value for P.E.I. in 1999.
- NAFO Division 4T (see map in appendix) landings [68] for oyster: (1975) 1,616t, (1980) 1,442t, (1985) 2,060t, (1990) 2,637t, (1995) 2,204t, and (1999) 3,397t.
- Oyster landings [68] occur predominately in statistical district 93 in P.E.I. (see map in appendix). Oyster licenses for district 93 are 143 (spring relay) and 136 (fall open). Oyster licenses province wide are 906 (spring relay) and 1,042 (fall open).

	10 year means (1990-99)		1999 landings	
	(metric tonnes)	($000)	(metric tonnes)	($000)
District 93	224	405	214	458
All districts	1,797	3,511	3,088	6,741
Gulf N.S. and P.E.I.				
Entire Gulf	2,311	4,684	3,225	7,173

- Malpeque Bay has a long history of oyster harvesting. «*The presence of middens along many shores proves that generations of Native Americans used oysters, soft-shells, quahogs, mussels, and snails as foods and for jewellery.* »[019]
- The oyster fishery operates in two seasons, a spring "relay" fishery, and a fall "open" season. The relay fishery involves harvesting on grounds designated contaminated. The harvest is relayed to non-contaminated water for depuration. Malpeque Bay is one of the areas where oysters are transferred for depuration. The relay fishery is open from April 15-July 15. The "open" season takes place from September 15-November 15.
- The oyster fishery is considered a coastal fishery (along with quahog, surf clam, soft-shell clam, marine plants, smelt, silverside, and eel fisheries). Limited entry licensing was introduced to the P.E.I. oyster fishery in 1987.
- Enhancement of the oyster fishery began in 1972; the program was referred to as the Oyster Development Program (ODP), and this was administered by DFO until 1994 when the Provincial Department of Fisheries took over administration of the ODP.
- Apart from the current management tools (season and size), few attempts have been made to try to find ways to control oyster fishing in public areas. This is basically because of the lack of information on the stock status, an effective monitoring protection and control program for landings and a statistics gathering system that would identify the location of the fishing effort.[05]
- There are other important commercial species, besides oyster, that are landed in statistical district 93. They are (1999 landed value order over $100,000):

Species	Value ($000)	Licenses (valid)	Season
Lobster (LFA 24)	7,574	74	May 1- June 30
Mussel	3,066	108 (mussel) 212 (clam unspecified)	Summer (wild) Year round (aquaculture)
Cod (3PN, 4R, 4T, 4S, 4VN)	156	46 (unspecified groundfish)	Varies
Snow Crab	119	2	July-Sept.
Softshell Clam	99	213	Summer

Support, favourable and unfavourable factors

- This site would benefit from Marine Environmental Quality (MEQ) standards, since water quality is of critical importance for the shellfish industry. The MEQ program would support an Integrated Management (IM) effort.
- Malpeque Bay is a Ramsar site (International conservation area for bird habitat, under the Ramsar traitee). –This international designation focuses attention on the importance of the site, but does not provide specific management measures.
- *Mi'kmaq of a Sacred Bay* - Lennox Island Aboriginal Ecosystem ten-year strategic planning process 1999 – 2009.
- Fishers and aquaculture operators could approve the protection of this habitat because they are concerned about the state of the resource.

Other associated significant habitats

- Malpeque Bay is a significant habitat included in fact sheets or appendices for: white hake (3.2.13), and also lobster, soft-shell clam, and mussel (see appendix).
- Oyster is associated with the following significant habitats: Tatamagouche Bay (3.4.1), the three rivers near Charlottetown (3.4.2), and Bedeque Bay (3.4.3).

References

O1: Jenkins et al., 1997

O3: MacNeil, J.L. & Assoc., 2001

O4: T. Landry, p.c., 2001

O5 : DFO (oyster), 1996c

O7: St-Jean et al., 1999

O8: NAFO, 2000

O9: DFO (Stats. Div.), data

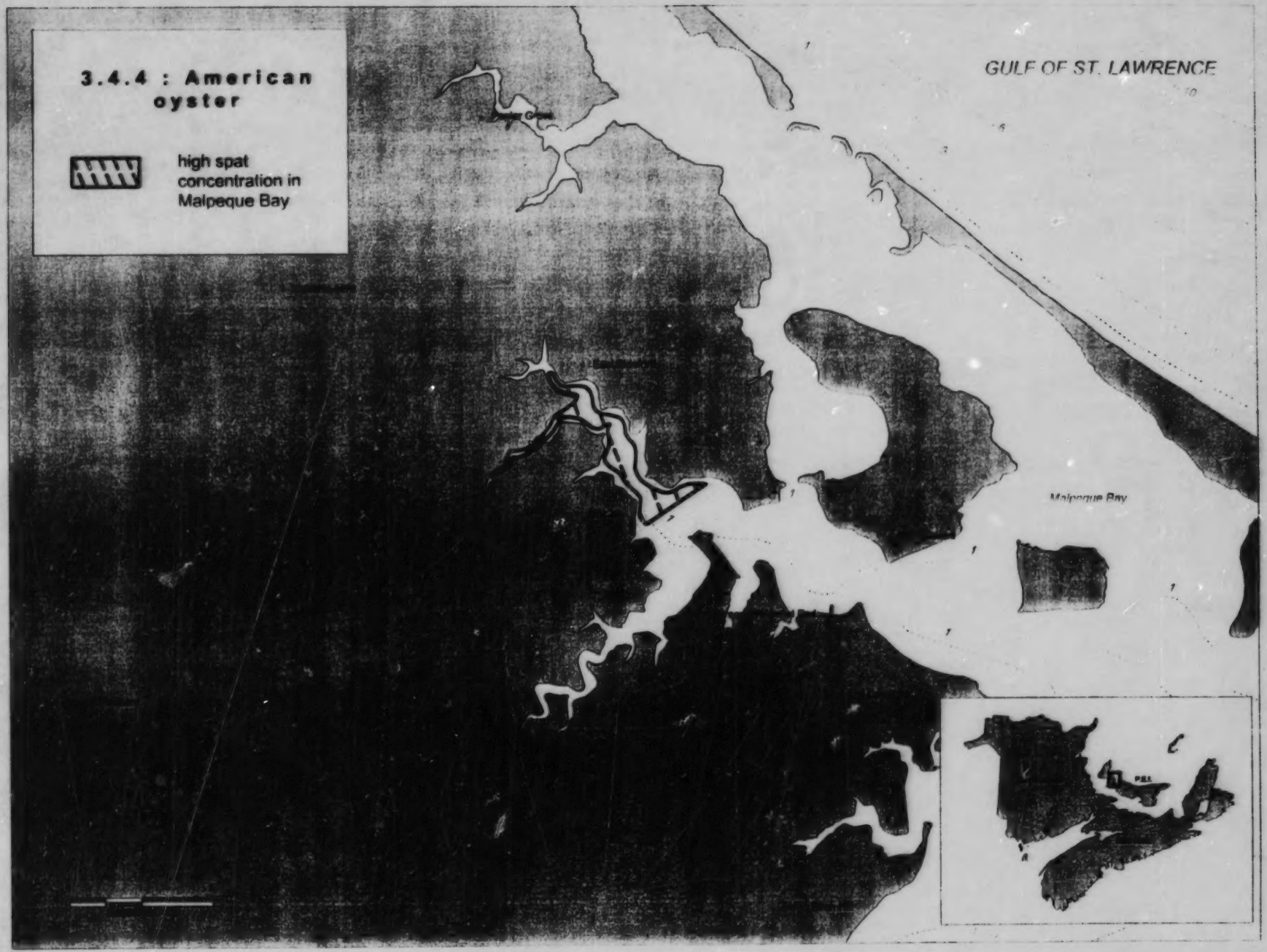
O11: J. Jenkins, p.c., 2001

O14: DFO, unpublished aquaculture leases data, 2001

O15: Somers et al., 1999, p.53

O18: J. Sheidow, p.c., 2001

O19: Jenkins et al, 1997, p.19


3.4.4 : American oyster
high spat concentration in Malpeque Bay
GULF OF ST. LAWRENCE
Malpeque Bay

3.4.5 Quahog high concentration in Wallace Harbour and Hillsborough Bay

Ecological Features

- Quahog beds are located on both shores of the Northumberland Strait in the Wallace Harbour and Charlottetown area. Major beds are mostly in Wallace Harbour [1-3] (N.S.), in the West, North and Hillsborough (East) Rivers near Charlottetown [2-5] (P.E.I.), particularly in the West River[5], and in Pownal and Orwell Bays [2-4,6] (P.E.I.) (figure 3.4.5). The resource is generally in shallow waters with muddy bottoms, between the intertidal and sublittoral inshore limits. [2,6]
- These are among the best known and most harvested quahog beds in the Southern Gulf, the others being Miramichi and Cocagne Bays (N.B.), and Percival and Inmore Bays (P.E.I.) (fact sheet 3.4.6). [3,4] Wallace Harbour is the only sustainable population of quahog on the Southern Gulf side of N.S. [7] Merigomish and Little Harbour are being commercially harvested at a smaller scale.
- These areas are also productive for other mollusc species such as oyster and surf clam in Wallace Harbour [1,2], oyster (fact sheet 3.4.2), blueback herring, eel and smelt [5,6] in the three rivers near Charlottetown, and surf clam, eel and smelt [4,6] in Pownal and Orwell Bays. There are notably some oyster aquaculture leases located in the upper part of the Hillsborough River, in the median part of West River, in the upper part of Pownal and Orwell Bays and up into Vernon River. [6]
- The species is near the northern limit of its West Atlantic range, with the natural limit of the population being the Miramichi Bay (N.B.). [2,6]

Vulnerability, threats and human pressure

- Being near its West Atlantic northern range limit, this species is sensitive to overexploitation. Recolonisation could be in jeopardy if a major decline should occur.
- Quahog could become a threatened species because of human activities. [3,6]
- In some bays where quahogs were at commercial levels, their disappearance due to disease or overfishing has been permanent. [7]
- All anthropogenic stress: increasing sedimentation activities (forestry cut-offs, urbanisation, etc.), agricultural use of chemical (pesticides, fertilisers which lowered the biochemical oxygen demand-BOD, etc.), and industrial pollution (anoxia events, etc.).
- Bivalve molluscs are subject to contamination from natural and anthropogenic causes. Natural causes include Paralytic Shellfish Poisoning (PSP) toxins (saxotoxin/neosaxitoxin), Amnesic Shellfish Poisoning (ASP)

toxins (domoic acid), and Diarrhetic Shellfish Poisoning (DSP) toxins (okadaic acid and about ten other associated toxins) as well as faecal coliform associated with the natural gathering of wild animals, such as geese and cormorans. Anthropogenic contamination is mainly associated with faecal coliform and E. coli bacteria resulting from human or animal waste contamination.

- Shellfish contamination is associated with the following contributing factors: treated and untreated municipal sewage discharges; land wash from agricultural and urban areas; seepage from poorly operating septic tank and tile field disposal systems; direct discharges of raw sewage from moored or anchored boats and from shore-side residences; treated and untreated industrial wastes; wildlife and domestic animals.
- *«Nutrient enrichment of P.E.I. estuarine environments is a growing problem, and too often has implications for dissolved oxygen levels as well. While much of the attention has been given to the role of nitrogen in the development of eutrophic conditions in Island estuaries, there is evidence that phosphorous levels may also be significant, perhaps even limiting factors in many of these cases.»* [10]
- A study has showed some organotin (TBT) contamination in estuaries of the Southern Gulf. Antifouling paint containing TBT have been banned for use on most vessels. Organotins can be resuspended in the water column when sediments are disturbed, or when boat hulls are cleaned near the water. Organotins are highly toxic to shellfish larvae. High levels of organotin are still present in harbours with larger vessel traffic. [13]
- Wallace Harbour is reported as the only non-contaminated bed in N.S. [2]
- Wallace Harbour is a waterfowl staging area during the fall season. Some duck species can prey on quahogs. [11]

Socio-economic characteristics

- Quahog is of high economic interest in P.E.I. and of economic interest in N.S., with harvest levels and participation being considerably higher in P.E.I. The quahog fishery is predominately a coastal fishery that is often a supplemental to oyster fishing.
- The relative stability of quahog landings in recent years may be related to a greater exploitation from contaminated stocks, which are transplanted elsewhere for depuration. [2]
- The NAFO statistics used in other sections does not apply to quahogs. DFO statistics from 1990 onward will be used instead. The 1990 quahog landings for all the Southern Gulf districts were 971t ($1,519,684); 1995 landings were 633t ($1,543,507); and 1999 landings were 866t ($2,931,657).

- Landing statistics do not include recreational harvesting which is considerable in many areas.[48] Wallace Harbour supports an important recreational and a First Nation ceremonial and food fishery.[47,412]
- The statistical districts associated with this fact sheet are district 46 (N.S.) and district 85 and 86 (P.E.I.) (see map in appendix). Ten-year mean landings for district 46 are 50.1t ($93,112). The 1999 landings were 86.3t ($246,361).

	10 year means (1990-99)		1999 landings	
	(metric tonnes)	($000)	(metric tonnes)	($000)
District 85	128	300	116	399
District 86	250	555	277	983
District 46	50	93	86	246
All districts Gulf N.S. and P.E.I.	662	1,528	805	2,774
Entire Gulf	801	1,797	866	2,862

- There are 55 unspecified clam licenses in district 46. In districts 85 and 86 there are 250 unspecified clam licenses and 1 quahog license.
- There are other important commercial species, besides quahog, that are landed in statistical districts 46, 85 and 86. They are (1999 landed value order over $100,000):

Species	Value ($000)	Licenses (valid)	Season
Lobster (LFA 26A)	3,851	78	May 1- June 30
Oyster (district 46)	204	62	Sept. – Oct.
Oyster (districts 85 and 86)	1,022	1,609	Apr. 15- July 15 (relay) Sept. 15- Nov. 15 (open)
Rock Crab	779	26	Aug. 16- Nov 13. (1999)
Scallop	334	26	Oct.- Dec. (Varies)
Softshell Clam	255	250	Summer
Bar Clam	119	254	Summer

Support, favourable and unfavourable factors

- Fishers and aquaculture operators could approve the protection of this habitat because they are concerned about the state of the resource.
- Quahog could be threatened due to human activity.
- This site would benefit from Marine Environmental Quality (MEQ) standards since water quality is of critical importance for the shellfish industry. The MEQ program would support an Integrated Management (IM) plan.

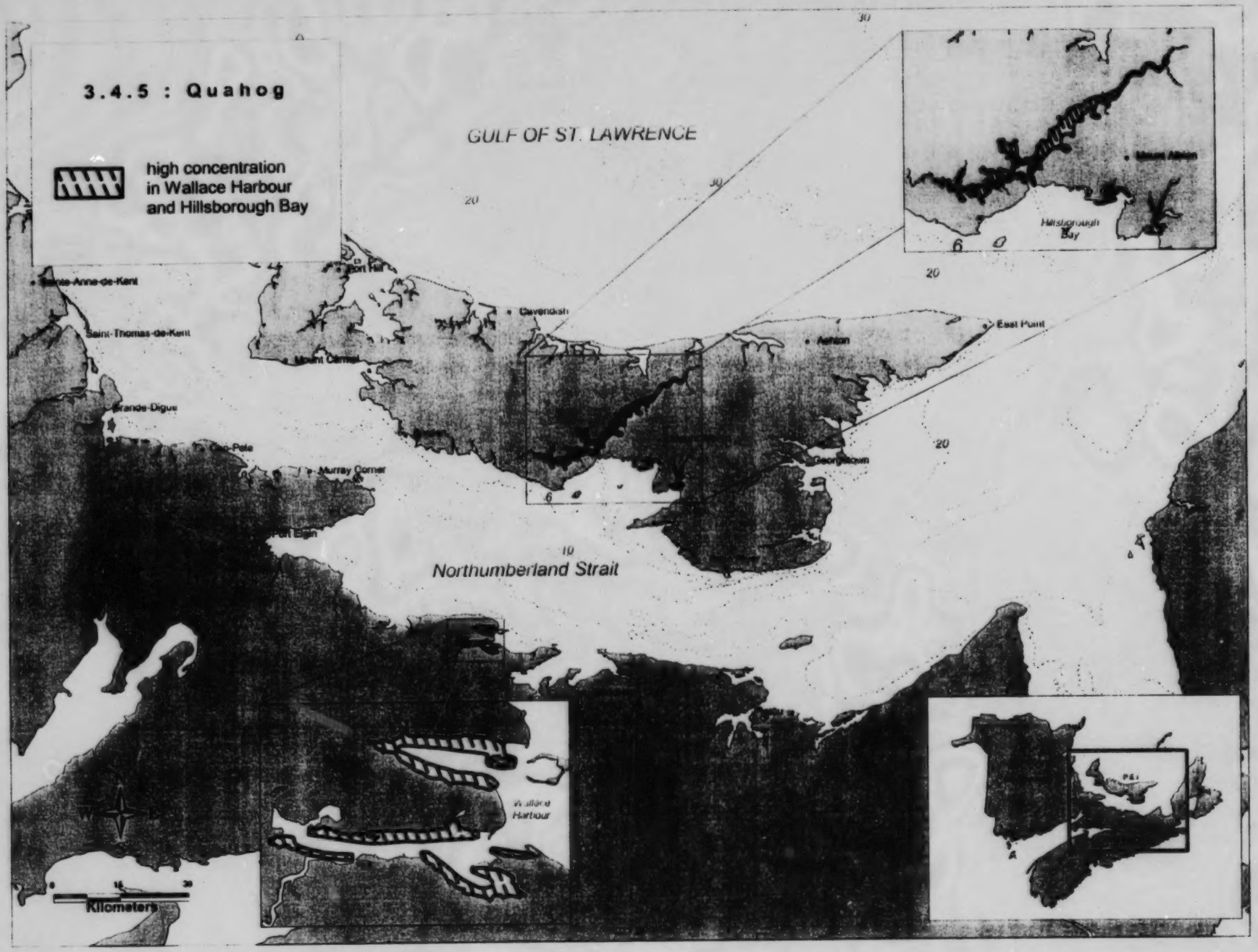
- This area is located within the Wallace Bay National Wildlife Area (Canadian Wildlife Service).
- Charlottetown is under pressure to begin efforts to clean up the harbour.

Other associated significant habitats

- Wallace Harbour and Hillsborough Bay are significant habitats included in fact sheets or appendix for: white hake (3.2.13), lobster (3.3.1), oyster (3.4.2), grey seal (3.5.1), and surf clam (appendix).
- Quahog is associated with the following significant habitats: Percival and Inmore Bays (3.4.6).

References

Q1: D. Austin and B. Scallion, p.c., 2001
Q2: Jenkins et al., 1997
Q3: DFO (quahog), 1996b
Q4 : M. Smith, p.c., 2001
Q5: Landry et al., 1999
Q6: MacNeil, J.L. & Assoc., 2001
Q7 : T. Landry, p.c., 2001
Q8: Cairns, 1997
Q9: DFO, unpublished aquaculture leases data, 2001
Q10: Somers et al., 1999, p.53
Q11: K. Davidson, p.c., 2001
Q12: C. Poirier, p.c., 2001
Q13: St-Jean et al., 1999


3.4.5 : Quahog
high concentration
in Wallace Harbour
and Hillsborough Bay
GULF OF ST. LAWRENCE
Cavendish
East Point
Northumberland Strait
Kilometers

3.4.6 Quahog bed in Percival and Inmore Bays

Ecological Features

- Major quahog beds along with collection sites located in Percival and Inmore Bays (P.E.I.) [02,04] (figure 3.4.6). The resource is generally in shallow waters with muddy bottoms, between the intertidal and sublittoral inshore limits. [02,03]
- This is one of the best known and most harvested beds in the Southern Gulf. The others being Miramichi and Cocagne Bays (N.B.), Wallace Harbour (N.S.), the three rivers near Charlottetown, Pownal and Orwell Bays (P.E.I.) (fact sheet 3.4.5). [03]
- Percival and Inmore Bays are productive areas, and some oyster aquaculture leases are located in the upper part of the bays. [05]
- The species is near the northern limit of its West Atlantic range, with the natural limit of the population being Miramichi Bay (N.B.). [02,03]

Vulnerability, threats and human pressure

- Being at its West Atlantic northern range limit, this species is sensitive to overexploitation. Recolonisation could be in jeopardy if a major decline should occur.
- Quahog could become a threatened species because of human activities. [03,05]
- In some bays where quahogs were at commercial levels, their disappearance due to disease or overfishing has been permanent. [07]
- All anthropogenic stresses: increasing sedimentation activities (forestry cut-offs, urbanisation, etc.), agricultural use of chemical (pesticides, fertilisers which lowered the biochemical oxygen demand-BOD, etc.), and industrial pollution (anoxia events, etc.).
- Bivalve molluscs are subject to contamination from natural and anthropogenic causes. Natural causes include Paralytic Shellfish Poisoning (PSP) toxins (saxotoxin/neosaxitoxin), Amnesic Shellfish Poisoning (ASP) toxins (domoic acid), and Diarrhetic Shellfish Poisoning (DSP) toxins (okadaic acid and about ten other associated toxins) as well as faecal coliform associated with the natural gathering of wild animals, such as geese and cormorans. Anthropogenic contamination is mainly associated with faecal coliform and E. coli bacteria resulting from human or animal waste contamination.
- Shellfish contamination is associated with the following contributing factors: treated and untreated municipal sewage discharges; land wash from agricultural and urban areas; seepage from poorly operating septic tank and tile field disposal systems; direct discharges of raw sewage from moored or

anchored boats and from shore-side residences; treated and untreated industrial wastes; wildlife and domestic animals.

- *«Nutrient enrichment of P.E.I. estuarine environments is a growing problem, and too often has implications for dissolved oxygen levels as well. While much of the attention has been given to the role of nitrogen in the development of eutrophic conditions in Island estuaries, there is evidence that phosphorous levels may also be significant, perhaps even limiting factors in many of these cases.»* [10]
- A study has showed some organotin (TBT) contamination in estuaries of the Southern Gulf. Antifouling paint containing TBT have been banned for use on most vessels. Organotins can be resuspended in the water column when sediments are disturbed, or when boat hulls are cleaned near the water. Organotins are highly toxic to shellfish larvae. High levels of organotin are still present in harbours with larger vessel traffic. [13]

Socio-economic characteristics

- Quahog is of high economic interest in P.E.I. The quahog fishery is predominately a coastal fishery that is often a supplemental to oyster fishing.
- The relative stability of quahog landings in recent years may be related to a greater exploitation from contaminated stocks, which are transplanted elsewhere for depuration. [6]
- The NAFO statistics used in other sections does not apply to quahogs. DFO statistics from 1990 onward will be used instead. 1990 quahog landings for all the Southern Gulf districts were 971t ($1,519,684); 1995 landings were 633t ($1,543,507); and 1999 landings were 866t ($2,931,657).
- Landing statistics do not include recreational harvesting which is considerable in many areas. [6]
- The statistical districts associated with this fact sheet is district 83 (P.E.I.) (see map in appendix).

	10 year means (1990-99)		1999 landings	
	(metric tonnes)	($000)	(metric tonnes)	($000)
District 83	126	358	175	693
All districts Gulf N.S. and P.E.I.	662	1,528	805	2,774
Entire Gulf	801	1,797	866	2,862

- There are 510 unspecified clam licenses and 1 quahog license in statistical district 83. There are other important species, besides quahog, that are landed in district 83. These species are (with a landed value order over $100,000):

Species	Value ($000)	Licenses (valid)	Season
Oyster	3,390	792	Apr. 15- July 15 (relay) Sept. 15- Nov. 15 (open)
Lobster (LFA 25)	2,308	60	Aug. 9 - Oct. 9 (1999)
Herring	402	49	Aug. - Sept.
Softshell Clam	158	512	Summer
Rock Crab	146	2	May - June
Smelts	100	28	Sept.- March

Support, favourable and unfavourable factors

- Fishers and aquaculture operators could approve the protection of this habitat because they are concerned about the state of the resource.
- Quahog could be threatened due to human activity.
- This site would benefit from Marine Environmental Quality (MEQ) standards, since water quality is of critical importance for the shellfish industry. The MEQ program would support an Integrated Management (IM) plan.

Other associated significant habitats

- Percival and Inmore Bays are significant habitats included in fact sheet for: lobster (3.3.1).
- Quahog is associated with the following significant habitats: Wallace Harbour and Hillsborough Bay (3.4.5).

References

Q2: Jenkins et al., 1997

Q3: DFO (quahog), 1996b

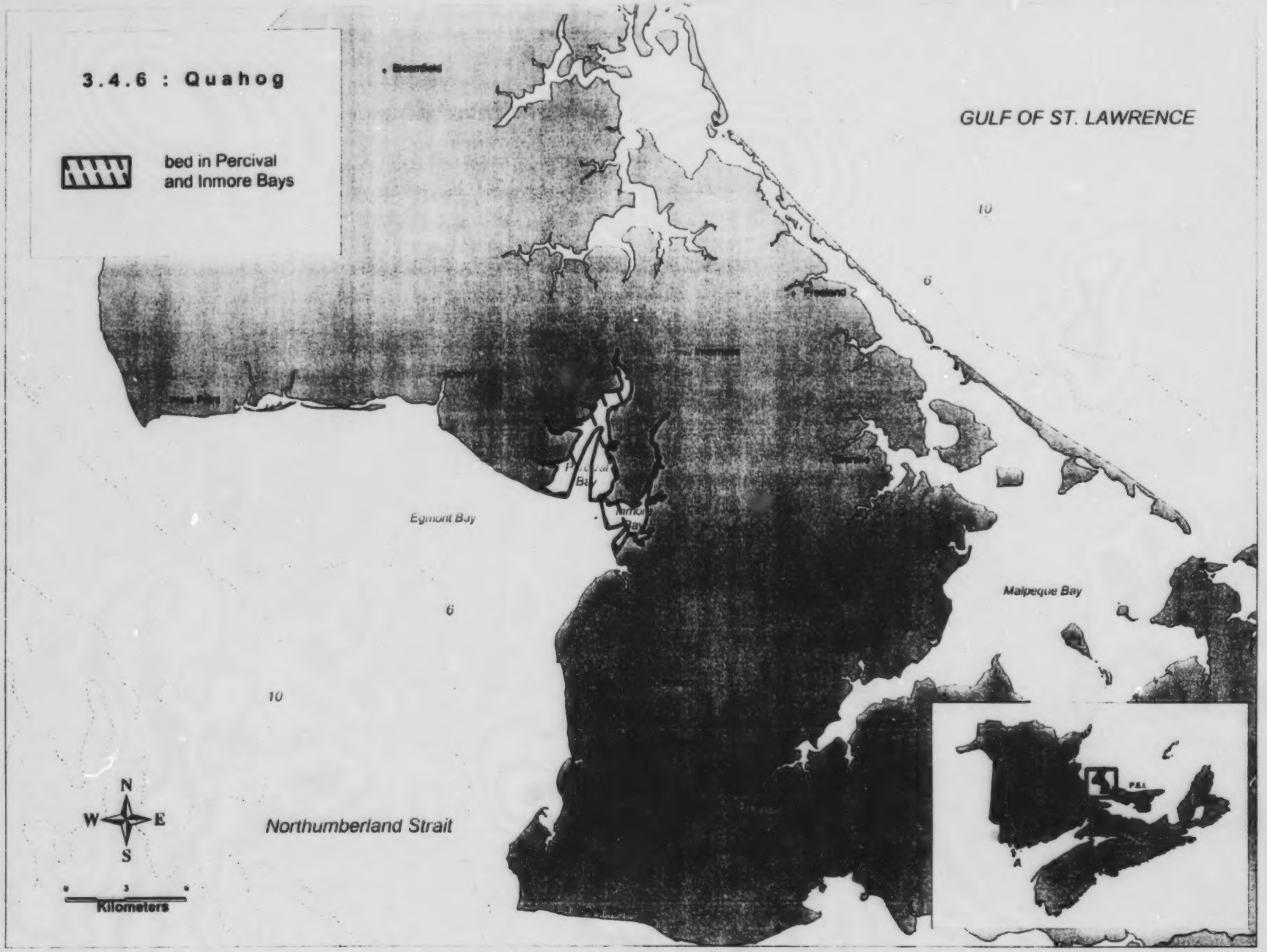
Q4 : M. Smith, p.c., 2001

Q5: Landry et al., 1999

Q9: DFO, unpublished aquaculture leases data, 2001

Q10: Somers et al., 1999, p.53

Q13: St-Jean et al., 1999


3.4.6 : Quahog
bed in Percival and Inmore Bays
GULF OF ST. LAWRENCE
Egmont Bay
Malpeque Bay
Northumberland Strait
N
W
E
S
3
Kilometers
PEI

3.4.7 Sea scallop recruitment beds along P.E.I. and western N.S.

Ecological Features

- Recruitment beds of sea scallop in the Southern Gulf are located in Shediac Valley, Northumberland Strait, around P.E.I., St. Georges Bay and on the west coast of Cape Breton [81-87] (figure 3.4.7). The boundaries of these habitats are approximate and based on the recurrent presence of scallop beds reported by fishers, and on several scientific surveys. These habitats represent the best areas for recruitment, but there may be some spatio-temporal variations in site boundaries. In the Southern Gulf, scallop beds are usually found between depths of 3 and 25 fathoms (5 m to 40 m). [86]
- In the fall, high densities of scallop spat can be captured along the coast at depths of 21-35 m [81], except in the narrow area of the Northumberland Strait between P.E.I. and N.S.
- Northumberland Strait is a highly productive area as shown by several fact sheets (3.1.1, 3.2.3, 3.2.4, 3.2.12 - 3.2.14, 3.3.1, 3.4.7, and 3.5.1) and appendices (3.2.16, 3,3,3, 3.3.4, 3.4.8, and 3.5.4), and by the recurrent high catches of several species including rock crab, lobster, herring, and mackerel. Current gyres border each end of the Strait. High productivity is associates with these gyres because they concentrate the nutrients and the plankton, and attract species at higher trophic levels. Details about the productivity of Pictou Harbour, Pictou Island and St. Georges Bay can be gathered in other fact sheets (3.6.1 to 3.6.3). Shediac Valley is also a highly productive area, containing notably the main nursery area for juvenile cod (3.2.2) and herring (3.2.5). [86] The area between east P.E.I. and N.S. is also known for its high productivity, notably the area of Fisherman's Bank and the Ridge (3.6.3) and by the concentration of tuna, attracted by high densities of several marine resources (3.2.14).

Vulnerability, threats and human pressure

- In the Southern Gulf, scallop is considered to be overexploited. «*Reported catches have been at about the same level since the early 1970s however actual catches are unknown. The 1997 survey suggests that stock abundance in SFA 22 was low compared with other years and with other scallop areas in Maritime Canada. This low abundance suggests that 202 licenses in SFA 22 exceed the limits of the resource. Overall, the Southern Gulf scallop fishery is likely overexploited (779 licenses only reported 246 t of catch), which suggests that effort should be reduced.*» [86]
- The use of the scallop drag is increasingly contentious and many consider its use to cause irreparable harm to the ocean floor. [810] Bottom trawling and

dragging have a harmful effect on groundfish habitat by flattening the bottom [s11], which could favour juvenile predation. Ice can have the same effect and on a larger scale. The drag rakes the seabed and captures the sedentary species. The benthic communities associated with the scallop beds is disrupted and often destroyed especially on hard bottom (rocky and gravel).

- Since 1999, there has been a buffer zone from East Point to Hillsborough Bay on the east coast of P.E.I., including Fisherman's Bank (see map in appendix). Fishers are not allowed to drag for scallops in this area.
- Sedentary species, such as scallops, are vulnerable due to the fact that directed harvest for adults is done on the same habitat where recruitment occurs.

Socio-economic characteristics

- The resource is overexploited throughout the Southern Gulf and no new licenses have been issued since 1978, however licences can be transferred. [s6]
- Vessels under 45 feet rigged with a «Digby drag» or a «Wood Island drag» mainly carry out the sea scallop fishery. Sea scallop fishers often participate in a combination of fisheries (lobster, herring, rock and snow crab, groundfish, and tuna) and usually do not participate in "coastal" fisheries (oyster, quahog, soft-shell and surf clams, smelts, marine plants, and eels).
- The scallop fishery is of high economic interest in the Southern Gulf of St. Lawrence. The origin of the commercial fishery in the Southern Gulf is not completely known. It has been suggested by several sources that the commercial harvest coincided with the development of larger gasoline powered motors in the 1930s. [s12,s13] The scallop fishery is usually considered a secondary fishery.
- Landing data represented in this section shows live weight and not meat weight. Sea scallops are mainly harvested for the adductor muscle (meat). Discussions surrounding scallop often refers to the meat count as the landing data; the ratio between live weight and meat weight is approximately of 8 to 1.
- NAFO Division 4T (see map in appendix) landings [s14] for sea scallop: (1975) 2,853t, (1980) 1,700t, (1985) 2,146t, (1990) 2,667t, (1995) 2,893t, and (1999) 1,467t.
- Significant landings occur in the statistical districts 11, 12, 13 and 46 (N.S.) and 82, 83, 86, and 87 (P.E.I.) (see map in appendix). Scallop licenses held in districts 82, 83, 86, and 87 are 267, and 117 for districts 11, 12, 13 and 46.

	10 year means (1990-99)		1999 landings	
	(metric tonnes)	($000)	(metric tonnes)	($000)
District 82, 83, 86, 87 (P.E.I.)	1,132	2,216	725	1,543
District 11, 12, 13, 46 (N.S.)	366	707	230	541
All districts Gulf N.S. and P.E.I.	1,613	2,411	744	1,612
Entire Gulf	2,803	5,232	1,547	3,067

- Fishing for scallop in this area (fact sheet 3.4.7) covers two entire Scallop Fishing Areas (SFA 23 and 24 - see map in appendix) and part of a third (SFA 22). SFA 24 is located off the north shore of P.E.I. (Season: (varies) October- December). SFA 23 is located in the eastern portion of the Northumberland Strait (Season: (varies) July-December). SFA 22 is located in the western portion of Northumberland Strait to the tip of P.E.I. (Season: (varies) May-June).
- There are other important commercial species, besides sea scallop, that are landed in statistical districts 82,83, 86 and 87. These are (1999 landed value order over $100,000):

Species	Value ($000)	Licenses (valid)	Season
Lobster (LFA 25 & 26A)	30,999	534	May 1- June 30 (LFA 26A) Aug. 9- Oct. 9 (LFA 25)
Oyster	3,828	639 (relay) 569 (open)	Apr. 15- July 15 (relay) Sept. 15- Nov. 15 (open)
Herring	2,658	413	Aug.- Sept.
Quahog	1,462	951	Summer
Rock Crab (LFA 26A)	1,228	32	Aug. 16- Nov. 13 (1999)
Irish Moss	855	149	Summer
Mackerel	579	519	May – Sept.
Bluefin Tuna	408	97	July- Nov.
Smelt	154	58	Sept.- March
Softshell Clam	153	956	Summer

- In statistical districts 11,12,13 and 46, these are (1999 landed value order over $100,000):

Species	Value ($000)	Licenses (valid)	Season
Lobster (LFA 26A)	19,421	335	May 1- June 30
Herring	1,277	298	Aug.- Sept.
Bluefin Tuna	870	82	July-Nov.
Rock Crab (LFA 26A)	438	40	Aug. 16- Nov. 13 (1999)
Quahog	369	79	Summer
Winter Flounder (3PN, 4R, 4T, 4S, 4VN)	185	122 (unspecified groundfish)	Varies
White Hake	117	122 (unspecified groundfish)	Closed (By-catch & Sentinel only)
Mussel	100	22	Summer (wild) Year round (aquaculture)

Support, favourable and unfavourable factors

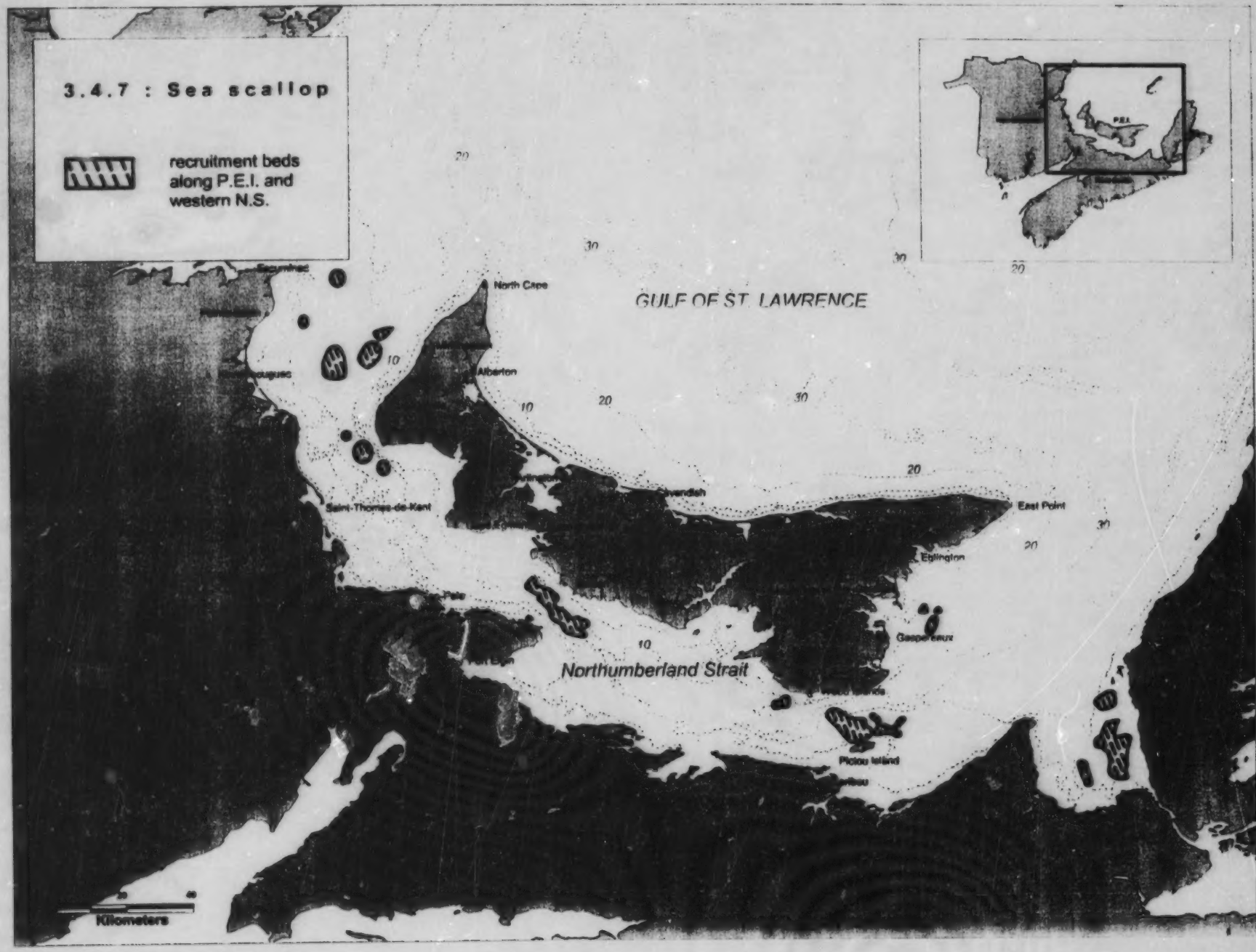
- Scallop fishers holding lobster-fishing licenses could favour the protection of such an area.
- The buffer zone restricting scallop drag fishing, which includes Fisherman's Bank, was implemented in 1999 from a mutual agreement between fishers, which shows their concern about resource conservation and habitat protection.

Other associated significant habitats

- The scallop beds along P.E.I. and western N.S. are significant habitats included in fact sheets or appendices for: cod (3.2.2), herring (3.2.5 and 3.2.7), bluefin tuna (2.3.14), lobster (3.3.1), grey seal (3.5.1), and Pictou Island (3.6.2), as well as rock crab, surf clam and grey seal (see appendix).
- Sea scallop is not associated with other significant habitats in this report.

References

S1: L.-A. Davidson, p.c., 2001
S2: Worms and Chouinard, 1982
S3: Worms and Chouinard, 1983
S4: Worms, 1984
S5: Worms et al., 1985
S6: Lanteigne et al., 1986
S7: MacNeil, J.L.& Assoc., 1998
S8: DFO (scallop), 1998c
S9: G. Chouinard, p.c., 1999 in Therrien et al., 2000
S10: M. Hanson, p.c., 2001
S11: Watling and Norse, 1998
S12: Jenkins et al., 1997
S13: Murray, 1999
S14: NAFO, 2000


3.4.7 : Sea scallop
recruitment beds along P.E.I. and western N.S.
GULF OF ST. LAWRENCE
North Cape
Alberton
Saint-Thomas-de-Kent
East Point
Eglington
Northumberland Strait
Pictou Island
Kilometers
PEI
10
20
30

3.5.1 Grey seal whelping ground in the southeast part of the Gulf

Ecological Features

- Grey seal migrate from their general herds location and form high densities for whelping from late December to mid February. The main concentrations form on Sable Island and on newly formed ice in the southeast part of the Southern Gulf (figure 3.5.1). [21-24]
- The dispersal occurs in March and April, and grey seals in summer and early fall are found throughout the northwest Atlantic coast from southern Labrador to Cape Cod, including the estuary and Gulf of St Lawrence. [21] Despite the wide range of wandering, most seals return to their place of birth to breed. [21]
- Example of the species' range of migration is given by colonies surveyed by telemetry by means of satellite. [25] Grey seals from Amet Island (N.S.) travel frequently west to Baie Verte (N.B).
- The theoretical biomass of marine prey consumption by the four species of seal (grey, harbour, harp and hooded) in eastern Canadian waters is estimated at about 4 million tons every year, from which about 1% is captured in the Southern Gulf. [212] Grey seals, like other pinniped, prey mostly on fish but also on invertebrates. [21,26] In the Southern Gulf, their diet is mainly composed of sand lace (45%), cod (19%) and herring (8%), with fish representing 97% of their diet. [212] Grey seals accounted for about 99% of the consumption of prey in biomass for the Southern Gulf, and have an average cod consumption per year of about 7000t in Division 4T (see map in appendix). [212]
- The population is split between the Gulf and Sable Island area. The Gulf population is reported to be growing at about 3% per year [210], with the actual number of animals being around 60,000 or 32% of the whole population (compared to 21,000 in 1970). [24,29] A survey done in 1999 confirmed that the Gulf grey seal pup production is no longer increasing and may have declined since 1990. [211] For the Sable population, the growing rate is at 13% per year and the population is of about 130,000 animals. [24,29]
- The number of seals (species undifferentiated) seems to be increasing around P.E.I. as shown from the results of a survey done with fishers. [23] Grey seal is the most abundant species of pinniped and they stay in the area all year.

Vulnerability, threats and human pressure

- The species is highly vulnerable during the breeding season when they concentrate in the same area, leaving their aquatic habitat for the ice cover where they are slower and exposed.

- The high density of fishing gear near the coasts, the increasing number of seals [212] and their behaviour of consuming prey entangled in gillnets, hooked on lines of trapped in lobster traps, has increased seals mortality in recent years. The estimation of seal mortality related to fishing gears was estimated at 790 individuals (species undifferentiated) in 1997 near P.E.I., for which the most frequent species would be harbour and grey seals. [20]

Socio-economic characteristics

- The main target of the seal harvest is the harp seal, followed by the hooded seal. The grey seal is of limited interest to harvesters.
- Most of the grey seal hunt takes place near the Magdalen Islands in the Gulf (206 were taken in 1998 around the Magdalen Islands). There is no TAC for grey seals and only a small number are hunted. In 1999, 98 grey seals were taken for commercial purposes in the Gulf. In 1998, it was 69 grey seals that were reported taken by sealers in Cape Breton. [211]
- Although grey seal meat has traditionally been in demand, the current markets for seal meat remain poor and the value of the pelt is much less than that of harp seal.

Support, favourable and unfavourable factors

- The species is perceived as a nuisance by some fishers because, like other pinniped, they have the potential to cause competition for prey, transmission of parasites to commercial species, and gear interference (prey stealing or damaging, gear damaging), that can all result in significant economic losses. [25] This species has the highest level of interaction with human activities because of its abundance (compared to harbour seal), and presence all year round (compared to harp and hooded seal). The cod predation by grey seal, approximately 7000t each year in the 4T Division [20], is substantial compared to the total cod TAC of 6000t in 4T. Nevertheless, the grey seal's impact on the cod fishery is hard to assess. In recent years, because of the very low abundance of cod, this impact could be temporarily more significant. Recent analyses do not indicate that seal predation is a major factor explaining the high natural mortality rate of cod. [213]
- Seals are a valuable natural resource that can be harvested wisely. DFO is committed to the conservation and sustainability of the seal resource to provide economic benefits to coastal communities. [211]
- DFO is committed to increase the understanding of abundance, distribution, and the potential impact of seals on fish stocks. [211]
- Eco-tourism operations are increasingly including seal watching in their activities.

Other associated significant habitats

- The southeast part of the Southern Gulf is a significant habitat included in fact sheets or appendices for: Irish moss (3.1.2), herring (3.2.3-3.2.5), mackerel (3.2.10), white hake (3.2.12 and 3.2.13), bluefin tuna (3.2.14), lobster (3.3.1), oyster (3.4.1 and 3.4.2), quahog (3.4.5), and scallop (3.4.7), as well as herring, rock crab and harbour seal (see appendix).
- Grey seal is associated with the following significant habitats: resting ground in Southern Gulf and concentrations west of P.E.I. (see appendix).

References

Z1: Mansfield, 1988

Z2: J.-F. Gosselin, p.c., 2001

Z3: Cairns et al., 2000

Z4: Hammill et al., 1999 (cod consumption)

Z5: Goulet, 1996

Z6 : Beck, 1983

Z7: Several authors in Hammill et al., 1999 (cod consumption)

Z8: Cairns, 2001

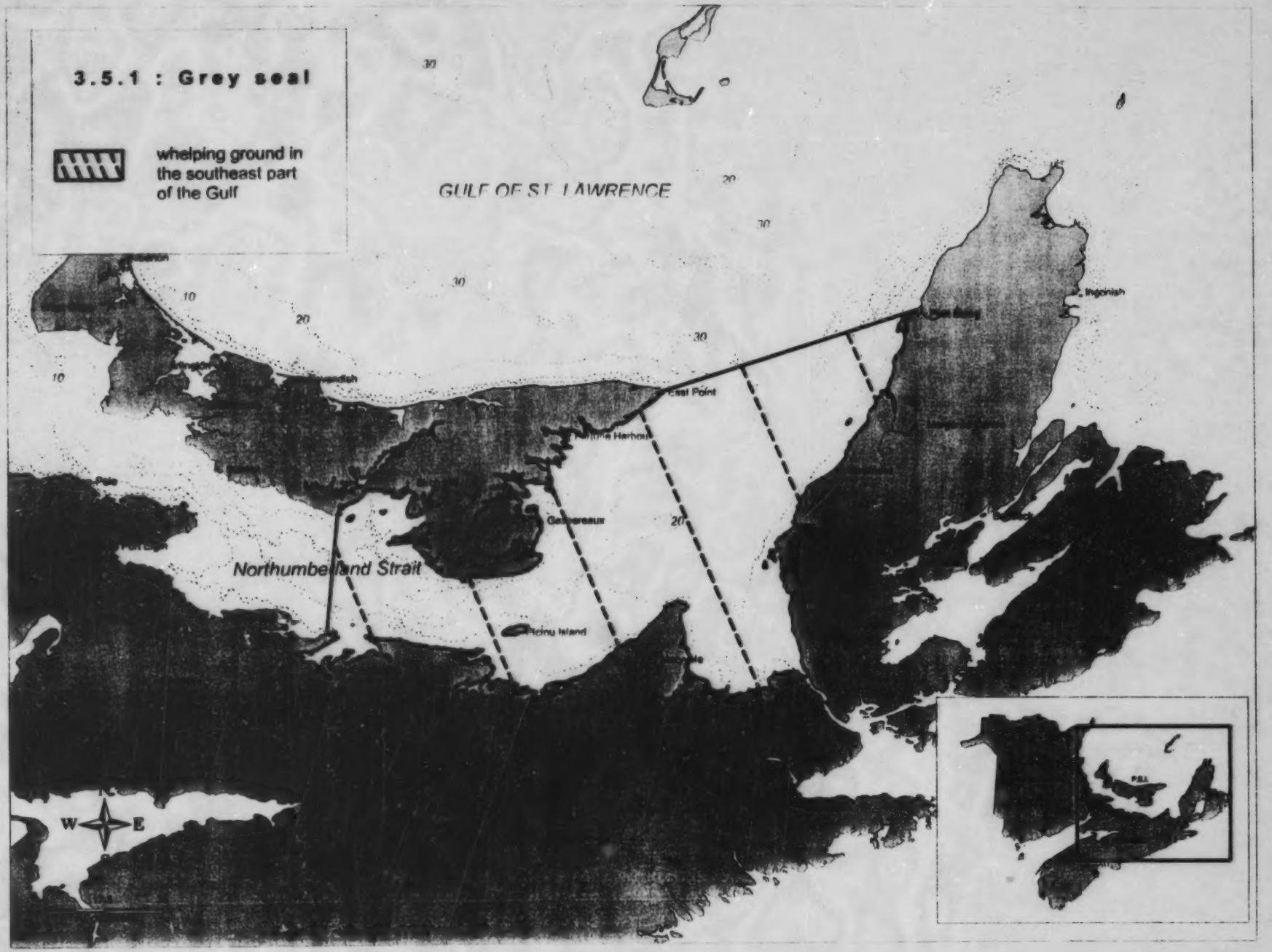
Z9: Hammill, 1999

Z10: Hammill et al., 1999 (grey seal)

Z11: DFO (seal hunt), 2001f

Z12: Hammill and Stenson, 2000

Z13: Swain et al., 2000


3.5.1 : Grey seal
whelping ground in the southeast part of the Gulf
GULF OF ST. LAWRENCE
Northumberland Strait
East Point
Inganish
W
E

3.5.2 Hooded seal whelping ground northeast of P.E.I.

- Hooded seals migrate from the Arctic and form high densities for whelping on the pack ice in March. [214] In eastern Canada, the main concentration forms to the northeast of Newfoundland, know as the "Front", and a small portion of the population uses the ice northeast of P.E.I. (figure 3.5.2). [22,26,214]
- The species lives in the Gulf usually only during the winter. [23] There may be more than one population and genetic determination is underway to verify that assumption.
- They return to the Arctic in spring and moulting occurs east of the Greenland Coast in July-August. [214] Wandering is pronounced in young individuals, and some have been found as far as Montreal, Cap Canaveral in Florida, the Caribbean Islands or, for the populations breeding in Greenland, as far south as Portugal. [214]
- The theoretical biomass of marine prey consumption by the four species of seal (grey, harbour, harp and hooded) in eastern Canadian waters is estimated at about 4 million tons every year, from which about 1% is captured in the Southern Gulf. [212] Hooded seals prey mostly on fish but usually in deep water, and their favourite prey are redfish, halibut, herring, cod and squid. [214,215] In the Southern Gulf, diet is mainly composed of Greenland halibut (42%), redfish (21%), cod (15%) and herring (14%), with fish representing 93% of their diet. [212] Harbour seals accounted for about 1% of the consumption of prey in biomass for the Southern Gulf, and have an average cod consumption per year of about only 28t in Division 4T (see map in appendix). [212]
- The number of seals (species undifferentiated) seems to be increasing around P.E.I. as shown from the results of a survey done with fishers. [23] The hooded seal is still rare compared to grey or harp seals. It is estimated that only 16,000 animals of the 500,000 total population visit the Gulf in winter. [24,216]

Vulnerability, threats and human pressure

- The species is highly vulnerable during the breeding season when they concentrate in the same area, leaving their aquatic habitat for the ice cover where they are slower and exposed.
- The presence of offshore fishing gears, the increasing number of seals [212] and their behaviour of consuming prey captured in different gear, has increased seals mortality in recent years. The estimation of seal mortality related to fishing gear was estimated at 790 individuals (species undifferentiated) in 1997 near P.E.I., for which the most frequent species would be harbour and grey seals. [23] Although animals were not always

identified to species, it is likely that hooded seals represent only a small portion of this number, since they are only present in the Southern Gulf in late fall and winter when most of the fishing activity is closed. [Z2]

Socio-economic characteristics

- The seal hunt is of economic interest in the Gulf of St. Lawrence. In Canada, the main target of the seal harvest is the harp seal, followed by the hooded seal. There are two areas of harp seal harvest activity: (1) Newfoundland/Labrador area known as the "Front" and (2) the Gulf of St. Lawrence area known as the "Gulf". There is also a harvest in Greenland. For hooded seal in Canada, the primary area of hunting is the "Front", and no harvest is allowed in the Gulf.

Support, favourable and unfavourable factors

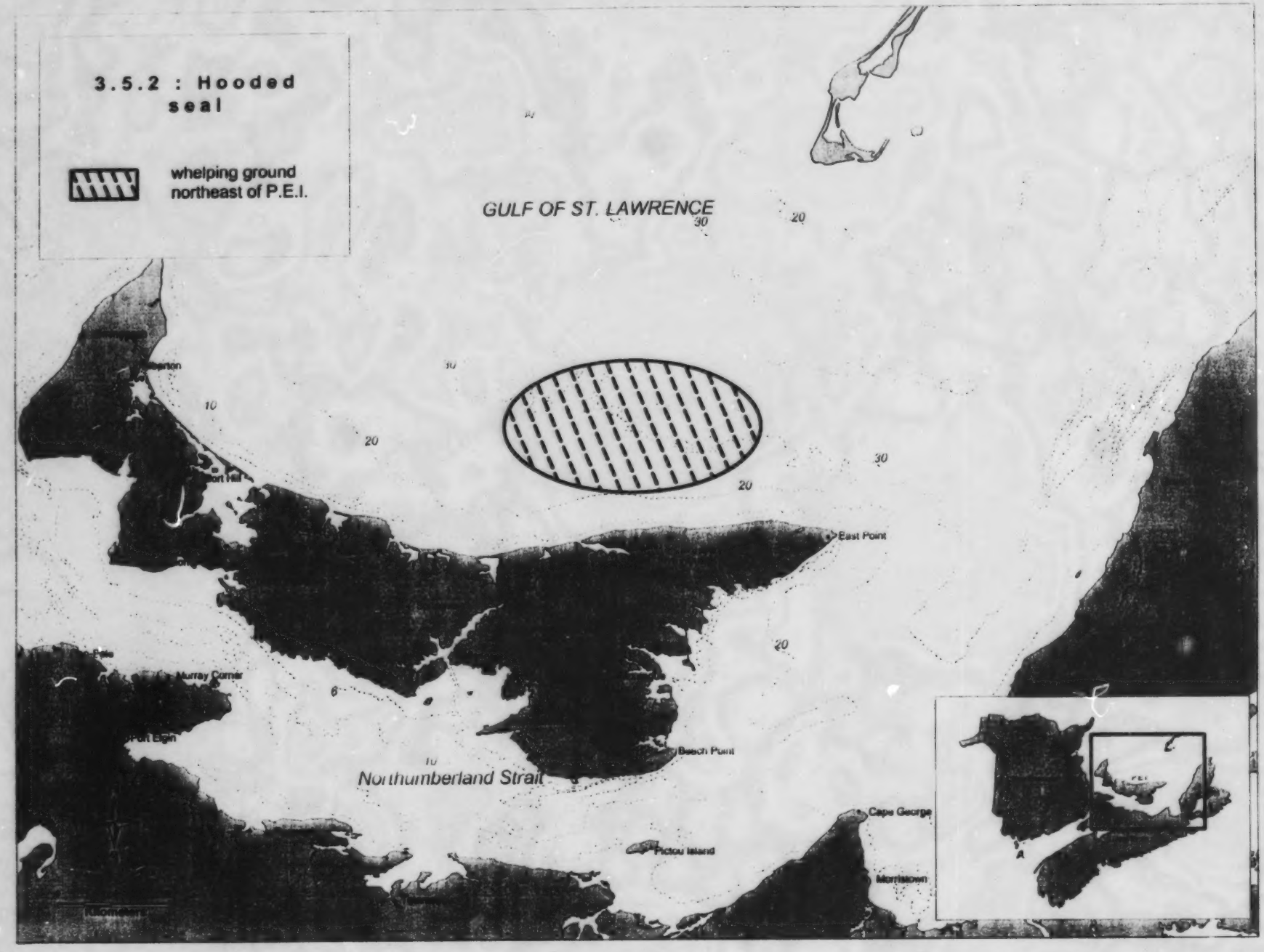
- The species is perceived as a nuisance by some fishers because, like other pinniped, they induce potential competition for prey, transmission of parasites to commercial species, and gear interference (prey stealing or damaging, gear damaging), that can all result in significant economic losses. [Z3] Nevertheless, this species is less abundant, does not stay in the area all year round, and feeds in deeper waters compared to grey seal, so its reputation is worst than its estimated real impact on the fisheries.
- Seals are a valuable natural resource that can be harvested wisely. DFO is committed to the conservation and sustainability of the seal resource to provide economic benefits to coastal communities. [Z11]
- DFO is committed to increase the understanding of abundance, distribution, and the potential impact of seals on fish stocks. [Z11]
- Eco-tourism operations are increasingly including seal watching in their activities.

Other associated significant habitats

- Northeast of P.E.I. constitutes a significant habitat included in fact sheets for: cod (3.2.2) and bluefin tuna (3.2.14).
- Hooded seal is not associated with other significant habitats in this report.

References

Z2: J.-F. Gosselin, p.c., 2001
Z3: Cairns et al., 2000
Z4: Hammill et al., 1999 (cod consumption)
Z8: Cairns, 2001
Z11: DFO (seal hunt), 2001f
Z12: Hammill and Stenson, 2000
Z14: Sergeant, 1985
Z15: Hammill and Stenson, 1997
Z16: Hammill et al., 1997


3.5.2 : Hooded seal
whelping ground northeast of P.E.I.
GULF OF ST. LAWRENCE
East Point
Murray Corner
Beach Point
Northumberland Strait
Cape George
Pictou Island
Merrimbeen

3.5.3 Harp seal whelping ground around North Cape

Ecological Features

- Harp seal migrate from the Arctic to form high densities for whelping in March to the northeast of Newfoundland, an area known as the "Front" and to the northern and Southern Gulf of St Lawrence. In recent years, the main concentration in the Southern Gulf has been located around North Cape (figure 3.5.3). [22,24,217] An area north of the Magdalen Islands is also a zone where whelping is occurring frequently. [24] About 13-51% (average 39%) of the herd enters the Gulf. [218]
- The species breeds in dense herds on pack ice less than 2 weeks after whelping. [24,217] After moulting, the dispersal occurs in the months of May and June. [24,217] The species is present in the Gulf only during the winter, but a small proportion of the population remains in the Gulf all year long. [24]
- The theoretical biomass of marine prey consumption by the four species of seal (grey, harbour, harp and hooded) in eastern Canadian waters is estimated at about 4 million tons every year, from which about 1% is captured in the Southern Gulf. [212] In the Gulf, the harp seal's diet is mainly composed of capelin (48%), redfish (14%) and flatfish (11%), with fish representing 91% of their diet. [212] Harp seal is not considered to feed in the Southern Gulf, but they accounted for about 92% of the consumption of prey in biomass for the Northern Gulf, which represent 660,000t, and have an average cod consumption per year of about 42,000t in area 4RS (see map in appendix). [212]
- A social movement against sealing began in Europe in the 1960's and flourished in the 1970's. Pressure from this movement helped sway public opinion in many European Nations, and by 1983 the European Economic Community banned the import of whitecoat (the first coat of the newborn harp seal) and blueback (first coat of newborn hooded seal) fur pelts.
- The population expanded quickly after the reduction in effort caused by the ban and the loss of market. Harp seals recovered from a population of less than 2 million in the early 1970's, to an estimated 5.2 million animals today. Increased hunting pressure since 1996 has likely stabilised the population to 5.2 million. [219]
- The number of seals (species undifferentiated) seems to be increasing around P.E.I. as shown from the results of a survey done with fishers. [23]

Vulnerability, threats and human pressure

- The species is highly vulnerable during the breeding season when they concentrate in the same area, leaving their aquatic habitat for the ice cover where they are slower and exposed.
- The high density of fishing gears near the coasts, the increasing number of seals [212] and their behaviour of consuming preys entangled in gillnets, hooked on lines of trapped in lobster traps, have increased the number of seals mortality in recent years. The estimation of seal mortality related to fishing gears was estimated at 790 individuals (species undifferentiated) in 1997 near P.E.I., for which the more frequent species would be harbour and grey seals. [23] Although, animals were not always identified to species, it is likely that hooded seals represent only a small portion of this number, since they are only present in the Southern Gulf in late fall and winter when most of the fishing activity is closed. [2]

Socio-economic characteristics

- In Canada there are two main areas of harvest activity: (1) Newfoundland/Labrador area known as the "Front" and (2) the Gulf of St. Lawrence area known as the "Gulf". There is also a harvest in Greenland. The primary area of activity for the seal occurs on the "Front".
- The harp seal has been historically of economic importance in the Gulf of St. Lawrence, although the traditional large vessel fishery did occur off the Newfoundland coast, in the "front". Since the 1983 ban on the importation of "whitecoat" pelts by the European market, harvest levels of harp seal dropped dramatically and the economic importance of the seal hunt in Canada has been greatly reduced, even though the main target of the seal harvest remains the harp seal, followed by the hooded seal. [211]
- A total of 3,528 and 3,127 animals were taken in the Gulf for 1999 and 1998 respectively; this is a dramatic increase compared to other years during the last decade. Previous harvests range from a low of 1 in 1990, to a high of 1,145 in 1996. [211] For the northwest Atlantic, annual harvest would be about 465,000 each year since 1997, including by-catch and losses (killed but not recovered). [219]
- The harp seal represents a classic example of the rural/urban dichotomy that exists in Canada and other parts of the World. In areas that have endured the collapse of the cod and other groundfish fisheries, the harp seal (and other seal species) have been viewed as a possible explanation for the collapse. There is little sympathy for the seal. This is juxtaposed against the aforementioned social movement that successfully lobbied for the end of whitecoat and blueback pelt harvests and changed the nature of the seal hunt.

- An eco-tourism market has been established to view and photograph the seal whelp (particularly in the Magdalen Islands). Vacationers are transported by helicopter to the ice floes to witness the whelping process. Many of the participants are interested in the natural aspect of the holiday and the chance to see first-hand the seal birthing grounds.

Support, favourable and unfavourable factors

- The species is perceived as a nuisance by some fishers because, like other pinniped, they induce potential competition for prey, transmission of parasites to commercial species, and gear interference (prey stealing or damaging, gear damaging), that can all result in significant economic losses. [Z3] The cod predation estimate for the entire Gulf of St. Lawrence (42,000t) [Z4,Z19] is substantial compared to the cod TAC of 13,000t. Nevertheless, its impact on the fisheries is hard to assess. In recent years, because of the very low abundance in the cod population, this impact could be temporarily more significant. But recent analyses did not indicate it is a major factor explaining the high natural mortality rate of cod. [Z13] As harp seal generally do not stay in the area all year long, and as they feed in deep water compared to grey seal, its reputation is worst than the real impact it has on fisheries.
- Seals are a valuable natural resource that can be harvested wisely. DFO is committed to the conservation and sustainability of the seal resource to provide economic benefits to coastal communities. [Z11]
- DFO is committed to increase the understanding of abundance, distribution, and the potential impact of seals on fish stocks. [Z11]
- Eco-tourism operations are increasingly including seal watching in their activities.

Other associated significant habitats

- North Cape constitutes a significant habitat included in fact sheets for: Irish moss (3.1.2), cod (3.2.2), herring (3.2.7-3.2.9), mackerel (3.2.11), and bluefin tuna (3.2.14).
- Harp seal is not associated with other significant habitats in this report.

References

Z2: J.-F. Gosselin, p.c., 2001

Z3: Cairns et al., 2000

Z4: Hammill et al., 1999

Z8: Cairns, 2001

Z11: DFO (seal hunt), 2001f

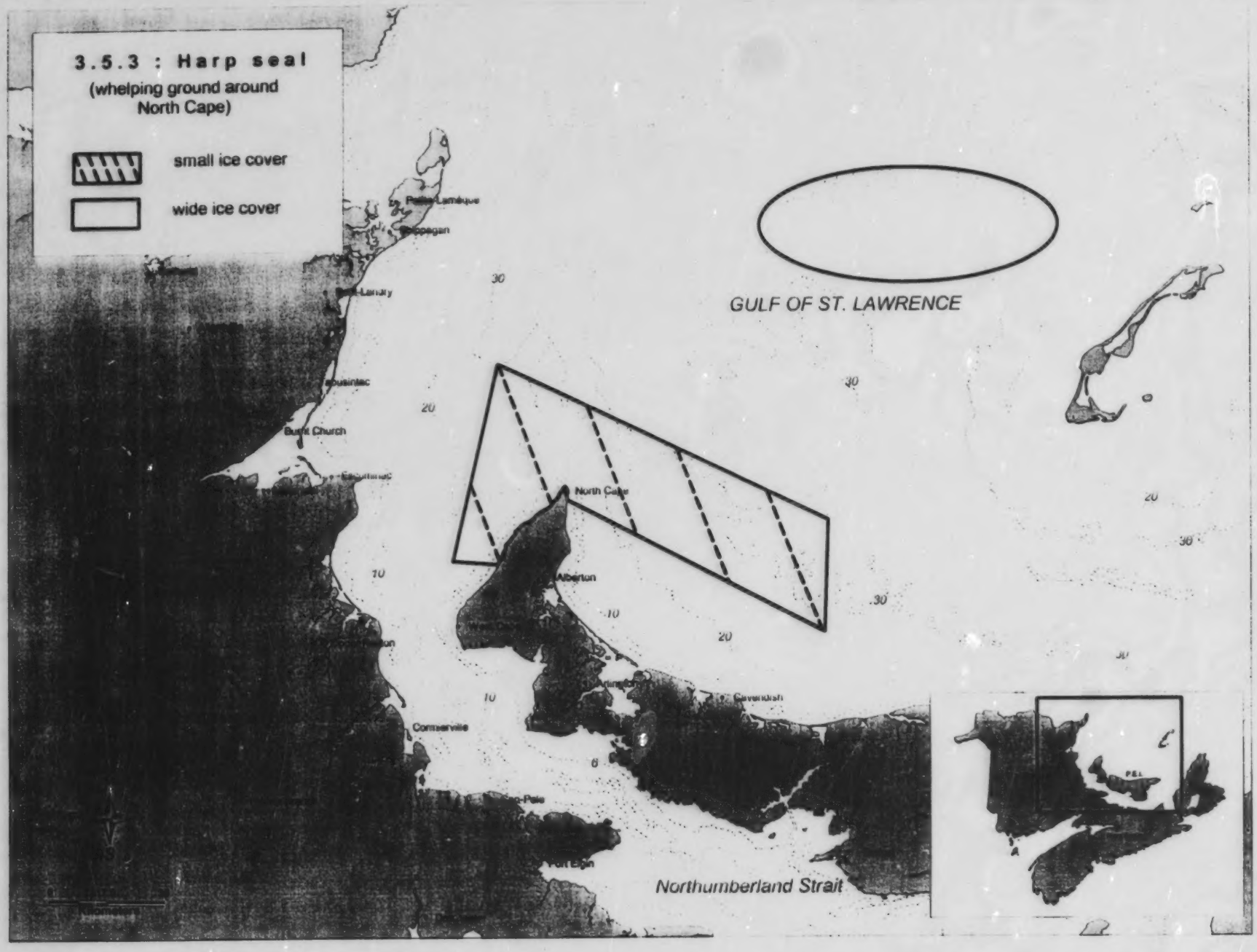
Z12: Hammill and Stenson, 2000

Z13: Swain et al., 2000

Z17: Bowen, 1991

Z18: Winters, 1978

Z19: DFO (harp seal), 2000b


3.5.3 : Harp seal
(whelping ground around North Cape)
small ice cover
wide ice cover
GULF OF ST. LAWRENCE
North Cape
Alberton
Cavendish
Tignish
Summerside
Port Hill
Northumberland Strait
PEI

3.6.1 Pictou Harbour

Ecological Features

- Pictou Harbour is an aquatic habitat located in a lowland area on the Northumberland Strait Coast (figure 3.6.1.).
- The harbour drains three rivers, the East, Middle and West Rivers of Pictou and is considered one of the most important estuaries in N.S. [81] The harbour occupies an area of approximately 53 km^2 with a drainage basin of approximately 980 km^2. [81] Tides are mixed, mostly semi-diurnal with a small range (<1 m). In addition, the harbour has a low flushing rate and the mixing is ensured mainly through wind and tidal action. [82]
- The area is known for its high productivity. It has major beds of oysters and mussels and smaller ones of softshell clams, quahogs and surf clams, although they are not harvested because of contamination. [83,84] The Pictou area supports an important recreational harvest of mackerel and is used as a migratory path or spawning area for several migratory fish species (blueback herring, capelin, eel, gaspereau, salmon, silverside, smelt, and striped bass – overwintering). [83,84] Other species found in the three rivers of the basin are, notably, northern pipefish, sea trout, brown trout, common sucker, mummichog, minnows, white perch, golden shiners, and banded killifish. [83] Furthermore, lobster, rock crab, scallop and herring harvesting areas are found close to Pictou Harbour. [85]
- The area is also a bird staging area for migratory species and is locally important for ducks and geese. [83] Some species depend on the estuary for the completion of their life cycle, among these we find the black duck, goldeneye, mergansers, double-crested cormorant, bald eagle, osprey, and piping plover. [83]
- The waters around this habitat border a gyre located at the eastern end of the Northumberland Strait. This area is known for its high productivity, which is the result of the dynamics brought on by the gyre. The gyre concentrates nutrients and plankton in this zone and consequently attracts species at a higher trophic level that come to feed.
- High concentrations of grey seals can be found at MacDonald's reef at the mouth of Pictou harbour.

Vulnerability, threats and human pressure

- Certain fish populations using the Pictou Harbour are endangered (striped bass) or are considered rare in this area (northern pipefish). [85] The Pictou watershed salmon population, known as one of the major runs in N.S., is in

difficulty as well as all Atlantic salmon populations, which are in decline in Canada. [65]

- The following is from a 1992 report: «*The environmental health of Pictou Harbour and surrounding watersheds was found to be generally good, though in many cases it is still significantly impacted by early and current pollution practices.*» [66]
- The report also states that «*...the watershed of Pictou Harbour has been significantly modified as a result of the construction of the Pictou causeway and creation of the Middle River reservoir. Though improvements to these structures have begun to lead to the restoration of fish populations, the West River estuary continues a slow process of infilling since its circulation patterns were restricted by the causeway.*»
- The communities of Trenton, New Glasgow and Stellarton have pollution abatement control, however, the Town of Pictou sewage outfalls continue to dump untreated sewage into Pictou Harbour.
- The harbour receives effluents from many industrial and municipal sources. It has been chosen as a study area for a research project involving the development of new bioindicators to assess the quality of the environment. [67] A previous study had identified some organotin (TBT) contamination in Pictou, as well as other estuaries in the Southern Gulf. [68]
- Canso Chemicals chlor-Alkali plant and Kimberly-Clark pulp and paper mill share an effluent pipeline that is directed into Boat Harbour. Although Boat Harbour is not part of the Pictou Harbour basin, it is in close proximity and discharges into the outer harbour area. The estimated discharge volume per year from both plants is 29,493,477 m^3. This volume is first discharged in Boat Harbour and then in the Northumberland Strait. [69]
- Mercury is associated with Chlor-Akali. It is reported in the State of the Environment [69] that Canso Chemicals has contributed 1,122 kg of mercury to the surrounding environment between 1976-1987 through liquid effluent, air, impounded solids, and products. Since the early 1990s, mercury from Canso Chemicals is treated onsite and does not flow into the Kimberly-Clark Boat Harbour pipeline. [69]
- Kimberly-Clark operates a pulp mill that uses chlorine to bleach pulp. This process is associated with higher levels of "Dioxins" and "Furans" (polychlorinated dibenzo-para-dioxins and polychlorinated dibenzo-para-furans). The effects of chlorination of "*some organic living substances can make them toxic, mutagenic, persistent, and likely to accumulate in living organisms.*" [10]
- The Trenton Power Generating Station (Nova Scotia Power) is a coal power plant with a capacity of 190 MW. Thermal generating stations discharge heated wastewater effluent in the marine environment. Some species (particularly salmon and trout) may be affected by this effluent which may form a thermal barrier that impedes their migration. These power generating

plants are also responsible for changes to pH levels in receiving waters, increased suspended solids, and accumulation of sediments near wastewater outfalls.

- In addition, thermal power generating is associated with point source air pollution. Sulphur Dioxide, nitrogen oxide, carbon dioxide, and polycyclic aromatic hydrocarbons (PAHs) are some of the emissions that are produced by these plants. These emissions have been identified as greenhouse gases and are associated with global warming.
- The P.E.I. ferry terminal is located at Caribou, which is in close proximity to the outer harbour.

Socio-economic characteristics

- The industrial development that occurs around the Pictou Harbour is the most prominent example of such development in the study area. This development aspect sets the Pictou Harbour habitat apart from the other chosen habitat sites. The history of this development stretches back to the establishment of coal mining on the Foord seam in the mid 19th century.
- Today, major industrial activity in the region surrounding Pictou Harbour consists of *Kimberly-Clark* pulp and paper mill (Abercrombie), *Michelin Tire* plant (Granton), *Maritime Steel* (New Glasgow), *Trenton Works* (Trenton), *Canso Chemical* chlor-akali plant (Abercrombie), *MacKay Meters* (Abercrombie), *Tibbet's Paints*, and *Nova Scotia Power* (Trenton) coal fired power generating station.
- The commercial aspect of fisheries in the harbour is somewhat limited. There is a commercial gaspereau fishery and traditional Aboriginal eel and salmon fisheries. The outer harbour area joins the Northumberland Strait and commercial fishing activities occur out of Caribou and Pictou Landing. The statistical fishing districts in proximity to Pictou Harbour are 11 and 12.
- Important commercial species harvested in statistical districts 11 and 12 are (1999 landed value over $100,000):

Species	Value ($000)	Licenses (valid)	Season
Lobster (LFA 26A)	7,986	175	May 1- June 30
Herring	1,259	166	Aug.- Sept.
Scallop (SFA 24)	467	78	Sept.- Dec. (Varies)
Rock Crab (LFA 26 A)	398	30	Aug. 16- Nov. 13 (1999)
Mussels	100	21	Summer (except aquaculture)

Support, favourable and unfavourable factors

- Marine Environmental Quality (MEQ) guidelines for the area are being developed under the Oceans Act.
- Pictou Harbour is an Environment Canada Atlantic Coastal Action Program (ACAP) site. The site is known as the Pictou Harbour Environmental Protection Project (PHEPP) and involves the community in an integrated approach to solving environmental problems.
- Without having official COSEWIC endangered species status, the striped bass population of the Gulf is very fragile because of its possible dependence on a single spawning ground in the Northwest Miramichi River. [E11] Therefore, the protection of all major habitat used by the species is a priority, this includes the overwintering site in Pictou Harbour.
- The Boat Harbour pulp and paper industry effluent may be re-directed to Pictou Harbour (3-Year plan).

Other associated significant habitats

- Pictou harbour is considered a significant habitat included in fact sheets for: herring (3.2.3), white hake (3.2.13), and grey seal (3.5.1).

References

E1: Environment Canada, 1990

E2: Krauel, 1969

E3: S.D. St-Jean and S.C. Courtenay, unpubl. data, 2001

E4: MacNeil, J.L. & Assoc., 2001

E5: MacNeil, J.L. & Assoc., 1998

E6: Painter and Stewart, 1992

E7: St-Jean, 2000

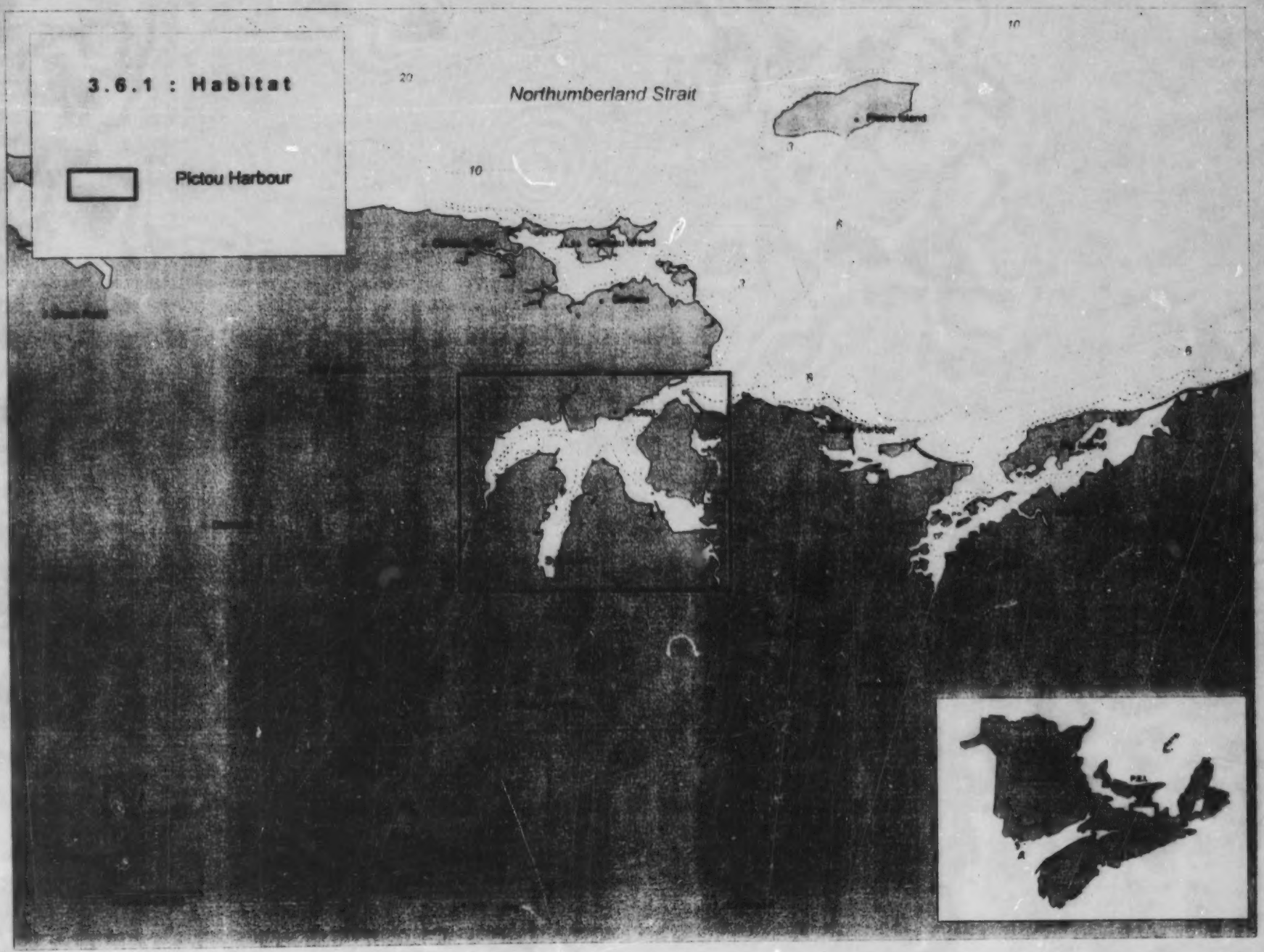
E8: St-Jean et al., 1999

E9: Eaton et al., 1994

E10: Eaton et al., 1994, p. 146

E11: Several authors in Therrien et al., 2000

E36: B. Christie, p.c. 2001


3.6.1 : Habitat
Pictou Harbour
Northumberland Strait
20
10
10
8
8
6
3
3

3.6.2 Pictou Island

Ecological Features

- Pictou Island area corresponds to the aquatic habitat surrounding that island in the Northumberland Strait (figure 3.6.2).
- This habitat borders a current gyre located at the eastern end of the Northumberland Strait. This area is known for its high productivity, which is the result of the dynamics brought on by the gyre. The gyre concentrates nutrients and plankton in this zone and consequently attracts species at a higher trophic level that come to feed.
- The area is known for its high productivity. There are herring spawning grounds around the island (fact sheet 3.2.3), major scallop beds to the north of it (3.4.7), and herring nurseries as well as grey seal whelping grounds in the general area around the island (3.2.5, 3.5.1). Furthermore, lobster, rock crab, scallop, and herring harvesting areas are found in this zone.[66] The island lies near the middle of the Strait, which is used as a migratory route for several pelagic fish and groundfish species.
- High concentrations of grey seals are also found at John Dan's Cove.

Vulnerability, threats and human pressure

- A buffer zone restricting scallop drag fishing surrounds the island, providing protection for lobster habitat.
- Green crab, an introduced European species has been identified in Pictou Harbour and in Caribou. This species is know to have a considerable impact when it invades new areas as it has no natural predators and consumes large volumes of shellfish.[E57]

Socio-economic characteristics

- Pictou Island is a small sparsely populated Island in the middle of the Northumberland Strait. The fishing banks around the Island are particularly important herring spawning grounds. However, most of the herring landings in this area are reported as data for mainland ports in district 11. This is due to the fact that location is mainly based on the ability to move the herring to market; buyers are usually located in areas conducive to truck transport.
- The Island has a rural based economy that sees year round residents generally depending on farming and fishing pursuits.

Support, favourable and unfavourable factors

- A DFO / industry co-operation model pilot project exists along the gulf coast of Nova Scotia. This co management project is located in the herring fishing area 16F. The arrangement produces funds that are used for research. The Gulf N.S. Herring Federation represents industry in the project in question.
- There is a three year Integrated Fisheries Management Plan (IFMP) and an annual herring harvesting Plan in place for that area.

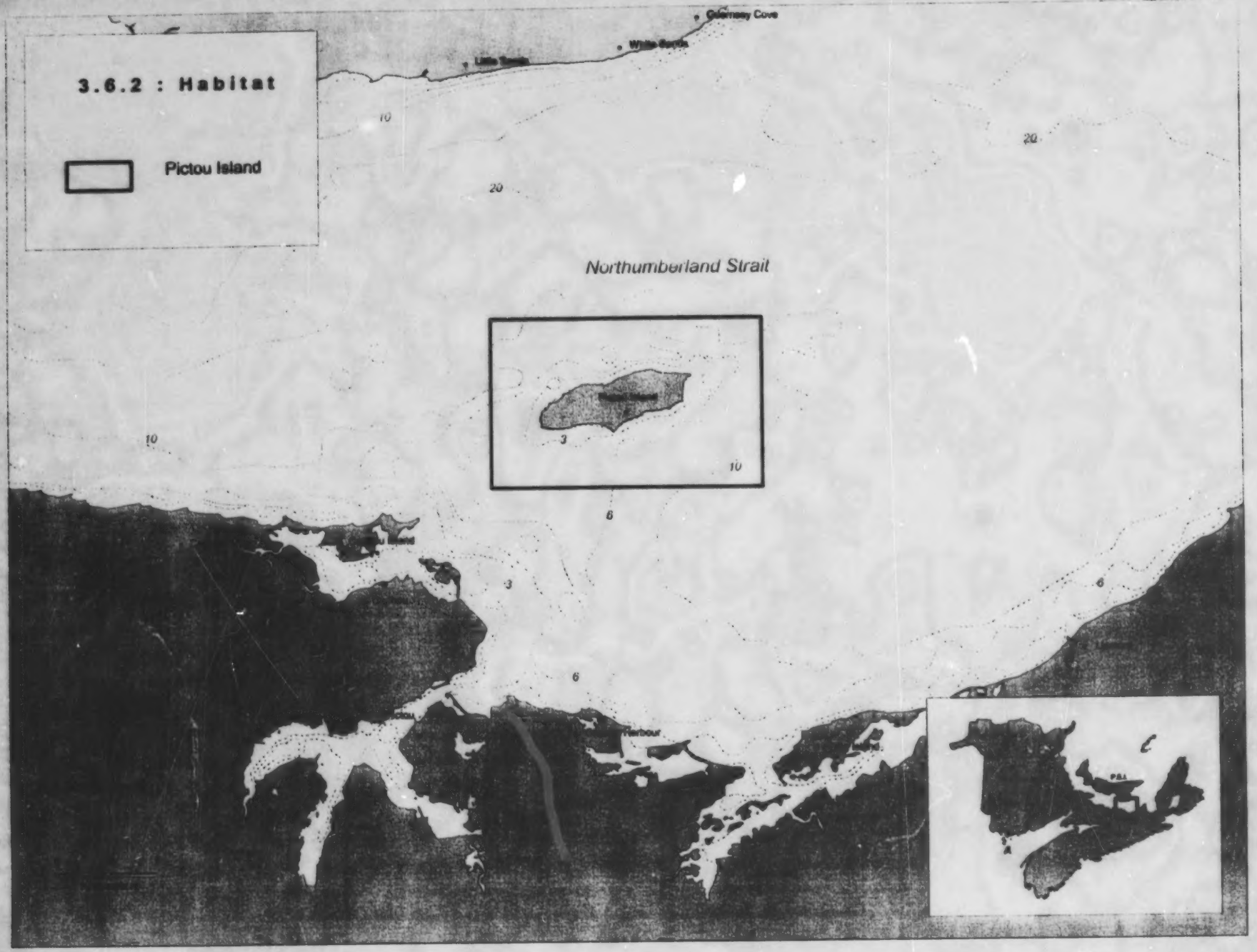
Other associated significant habitats

- Pictou Island area is a significant habitat included in fact sheets for: herring (3.2.3, 3.2.5), scallop (3.4.7), and grey seal (3.5.1).

References

E5: MacNeil, J.L. & Assoc., 1998

E37: A. Locke, p.c. 2001


3.6.2 : Habitat
Pictou Island
Northumberland Strait
Caribou
Pictou
Harbour
10
20
3
6

3.6.3 St. Georges Bay

Ecological Features

- St. Georges Bay is an aquatic habitat located at the convergence of Northumberland Strait, Cape Breton and the Canso Strait (figure 3.6.3).
- The bay drains several rivers, including Rights, West and South Rivers in the Antigonish Harbour watershed, West Pomquet and Black Avon in the Pomquet River Watershed, and several minor streams (Afton, Monastery, Tracadie, Little Tracadie and Wrights).
- St. Georges Bay is a very productive habitat characterised by bottom sediments dominated by sand and gravel with finer substrate in the centre of the bay. It has a wide surface (about 1000 km^2), a mean depth of 30 m, an average freshwater input of 37 m^3/s, and a water temperature reaching 19°C in the summer. Furthermore, the bay is characterised by a clockwise gyre with currents of 10 cm/s in surface and decreasing with depth. The Canso Strait links St. Georges bay with the colder Atlantic Ocean and the Scotian Shelf. [12] The Canso causeway built between 1952-54 is responsible for the narrowing of the Strait, which consequently has changed the velocity of the current flowing from the bay to the strait. However, there is no evidence that the volume of water and the flushing time is different now than it was prior to 1952. [12]
- The productivity is reflected by the presence of 65 species of fish, dominated by sculpins (Cottidae), codfishes (Gadidae), flounders (Pleuronectidae), herring (Clupeidae), sticklebacks (Gasterostidae), skates (Rajidae) and pricklebacks (Stichaeidae), of which 23 are commercially, harvested. [12] Several migratory species are present in the bay, notably alewife, blueback herring, eel, salmon, Atlantic sturgeon, bluefin tuna, sea trout, shad, and smelt. [12] The bay is notably a spawning ground for herring (fact sheet 3.2.3), mackerel (3.2.10), and white hake (3.2.12), as well as a nursery for herring (3.2.5) and white hake (3.2.13).
- Numerous crustaceans and molluscs inhabit the bay, including lobster, mussel, oyster, quahog, rock crab, sea scallop (fact sheet 3.4.7), snow crab, softshell clam, squid, stone crab, surf clam, and toad crab. However, most of the shellfish areas are closed because of contamination. [4,12]
- Grey seal also inhabit the bay at their whelping (fact sheet 3.5.1) and breeding sites. [12]
- There are numerous seabirds in St. Georges Bay including double-crested cormorant, black-back, herring and Iceland gulls, common and arctic terns, gannet, black-legged kittiwakes, and black guillemots. [12] The shores and estuaries of the bay are also rich and used as a feeding ground for resident birds and migrating waterfowl. [13]

Vulnerability, threats and human pressure

- Water quality in St. Georges Bay is considered to be good. «*The water, sediment and biota of St. Georges Bay have been sampled for various contaminants. Heavy metals, PCBs, and organochlorines have been analysed and are generally at relatively low levels. St. Georges Bay is often considered "clean" and used as a reference site, however sensitive test using MFO induction indicate there may be some contamination of the environment.*» [12]
- Despite this consideration, untreated sewage water and/or agricultural runoff can episodically and locally alter the water quality.
- From analyses done at the end of the 1970's, it seems the partial closure of the Canso Strait with the building of the Canso Causeway in 1954 did not have any major impacts on the fish population. [14] Following the construction of the causeway a decline in mackerel and herring populations was observed, however these were the result of other factors such as water temperature and/or epizootic diseases. Afterwards, the populations fully recovered. However, the construction may have had an impact locally in St. Georges Bay and in the surrounding area, by stopping the migration of fish, notably mackerel and tuna, who migrate northward in spring and southward in fall through the Strait. [14] If the impact on fish population could not be identified, it was a different story with lobster. The project was considered one of the possible causes of failure in recruitment in Chedabucto Bay, at the south end of the Strait, because of the blockage of larvae supply from the St. Georges Bay. However, other causes (overfishing, climate and/or environmental effects) are also suspected. [14]
- Green crab, an introduced European species has been identified in St. Georges Bay. This species is know to have a considerable impact when it invades new areas as it has no natural predators and consumes large volumes of shellfish. So far, the concentration of green crab measured in St. Georges bay is the highest reported in the Southern Gulf of St. Lawrence. [37]

Socio-economic characteristics

- St. Georges Bay is an important area for the commercial fishery in northeast N.S. and western Cape Breton. A variety of species are harvested in the area, lobster being the most important fishery. The tuna and herring fisheries are also very significant for the area. Groundfish has been historically important but has waned with collapse and closure. Many in the area hope to witness a revival of the cod and white hake fisheries, some signs may point to optimism. This optimism must be grounded with the consideration that higher numbers of white hake and cod in the St. Georges Bay area may be a

result of a distribution shifting eastward as opposed to a recovery of these groundfish stocks.

- Important commercial species in statistical districts 3 and 13 are (1999 landed value order over $100,000):

Species	Value ($000)	Licenses (valid)	Season
Lobster (LFA 26 A & B)	13,700	268	May 1-June 30
Bluefin Tuna	1,779	92	Aug.- Nov.
Snow Crab (Area 18 & 19)	1,544	35	July- Sept.
American Plaice (3PN, 4R, 4T, 4S, 4VN)	228	162 (groundfish unspecified)	Varies
Winter Flounder (3PN, 4R, 4T, 4S, 4VN)	161	162 (groundfish unspecified)	Varies
White Hake (3PN, 4R, 4T, 4S, 4VN)	152	162 (groundfish unspecified)	Closed (By-catch & Sentinel only)

- St. Georges Bay area offers a variety of beaches and is an important tourism destination. Provincial beach parks are located at Pomquet, Bayfield, and Port Hood. There are many other beach areas in the region that are used by both locals and tourists. These include Cribbons beach, Mahoneys Beach, Dunns Beach, Monks Head beach, West Tracadie Beach, Harve Boucher, Judique, Marysville, and McKays Point, among others. The near shore surface waters of St. Georges Bay reach temperatures (~20 ºC) that support watersport activity.

Support, favourable and unfavourable factors

- This area is the focus of many studies and reports. The St. Georges Bay Ecosystem Project (GBEP) has assembled much of this research in manuscript reports of the Fisheries and Aquatic Sciences series.
- Antigonish Harbour is located within this zone. There is an Environmental Assessment Project currently in progress.
- A Wildlife Management Area is also located in Antigonish Harbour.
- Ecosystem or multi-species management efforts are required for this diverse area.
- The St. Georges Bay Ecosystem Project (GBEP) is a collaborative partnership between St. Francis Xavier University, marine harvester's organisations, Mi'kmaq Fish & Wildlife Commission (MFWC) and Fisheries & Oceans. The intent of the project is to document and conduct applied analyses of the marine and human ecology of St. Georges Bay. This includes the area between Lismore, Pictou County and Pleasant Bay, and Inverness County.

Other associated significant habitats

- St. George Bay is a significant habitat included in fact sheets for: Irish moss (3.1.2), herring (3.2.3, 3.2.5), mackerel (3.2.10), white hake (3.2.12, 3.2.13), bluefin tuna (3.2.14), and grey seal (3.5.1).

References

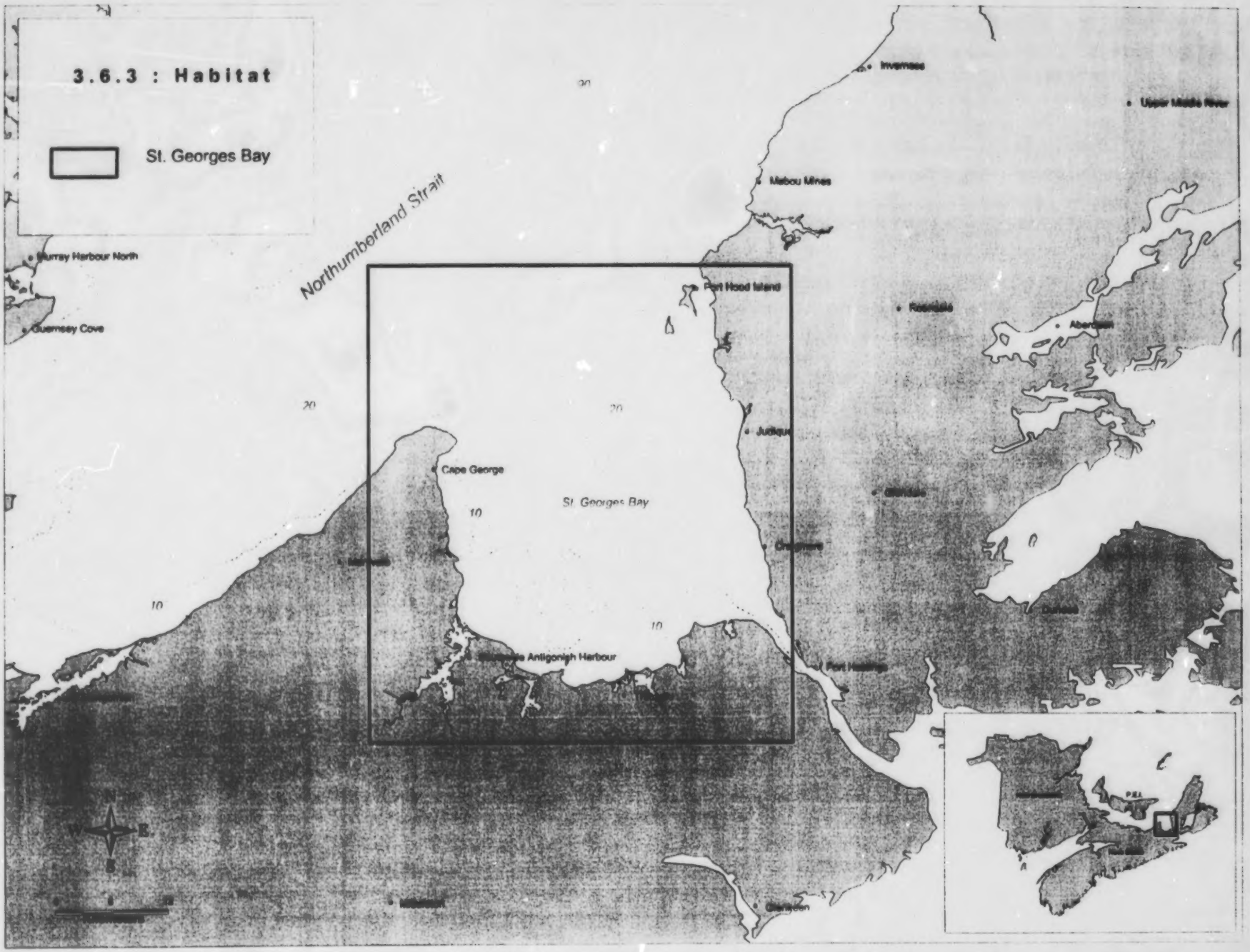
E4: MacNeil, J.L. & Assoc., 2001

E12: Davis et al., 2000, and several authors cited within

E13: Seymour, 1997

E14: McCraken, 1979

E37: A. Locke, p.c. 2001


3.6.3 : Habitat
St. Georges Bay
Northumberland Strait
Inverness
Upper Middle River
Mabou Mines
Murray Harbour North
Guernsey Cove
Port Hood Island
Judique
Cape George
St. Georges Bay
Antigonish Harbour
Port Hastings
PEI
20
10

3.6.4 Margaree estuary

Ecological Features

- Margaree estuary is an aquatic habitat on the west shore of Cape Breton (figure 3.6.4). The Margaree River drains an extensive and diverse watershed totalling 122,255 hectares. [12]
- The estuary supports beds of several shellfish (mussel, oyster, quahog, and softshell clam). It is used as a migratory path or spawning area for several migratory fish species (gaspereau, eel, salmon, sea trout, smelt) [12,15], that are all harvested commercially or recreationally.
- It supports the largest gaspereau run and the healthiest salmon population of the Gulf N.S. It is also a major birding area. [15]
- The Margaree estuary is unique in that during the spring runoff enough freshwater is discharged to keep the estuary fresh during all phases of the tide. The Margaree River basin drains a large portion of the Cape Breton Highlands, at its highest elevation it reaches 366 m.
- The Margaree River is really a complex of two rivers, The Northeast Margaree River and the Southwest Margaree River. The warmer Southwest Margaree drains Lake Ainslie (a 56 km^2 lake) and the colder Northwest Margaree drains part of the Cape Breton Highlands Plateau.

Vulnerability, threats and human pressure

- The Margaree drainage basin is a remote and relatively undeveloped area with a population of less than 1000 people. The area is heavily dependent on primary industries, such as forestry and fishing.
- Inverness County landfill site and an abandoned barite mine adjacent Lake Ainslie impact the overall quality of the river. Agricultural runoff and a lack of sewage treatment are problematic, as in many other rural areas. Lake Ainslie also has a public beach and some cottage development.
- Although the recreational salmon fishery is presently managed as a catch and release only fishery (due to dwindling returnees) there is still stress placed upon the ecosystem by this fishing activity.

Socio-economic characteristics

- The Margaree River has supported recreational salmon fishing for many years. The recreational fishery, the scenic Margaree river, the magnificent vistas of the Cabot Trail and the Cape Breton Highland National Park are some of the features that attract and support an important tourism industry in the area.

- There is a limited amount of agriculture in the area. Agriculture is based mainly around Lake Ainslie and the valley that follows the Southwest Margaree River to the ocean.
- A salmon hatchery has been in place on the river since 1902. It was operated by DFO until 1996 and is now a community-based enterprise.
- The Margaree harbour has an important gaspereau fishery. Lake Ainslie, which drains into the Southwest Margaree River, is the spawning habitat for the gaspereau.
- Harvests from the Margaree Harbour represent between 15-40% of all gaspereau landings in the Gulf of St. Lawrence. This important local fishery is unique because of its method. Fish are caught and processed (salted) in a matter of minutes, with minimum handling and spoilage, thanks to a very old technique passed down through generations. The salted gaspereau is sold on the Caribbean market.
- Gaspereau (May-June), Eel (September-October), and Smelt (October 16-February 28) are commercially harvested from the harbour estuary. Licenses held for these species in statistical district 2 are as follows: gaspereau (48 licenses), eel (26 licenses), smelt (22 licenses).
- Salmon and trout are angled recreationally from May to October. Recreational fishing effort for Inverness County was reported to be 69,068 angler/days in 1997.[e7] Salmon catches on the Margaree River in 1997 were 228 small salmon and 1536 large salmon. This is estimated to have an economic impact of approximately $1 M for the local economy over a ten-year average of salmon landings (including catch and release fish).[e12] Justification for the amount is made by the large number of non-resident licenses issued for Inverness County (40% of provincial total) and a $370 estimate for direct spending per salmon caught.

Support, favourable and unfavourable factors

- The Margaree is a Canadian Heritage River.
- Margaree Island, located at the mouth of the harbour is a National Wildlife Area.
- Salmon populations have been declining throughout Canada. There is considerable local support to protect this habitat.
- There are a number of community based associations in the area working toward management and conservation of the ecosystem.

Other associated significant habitats

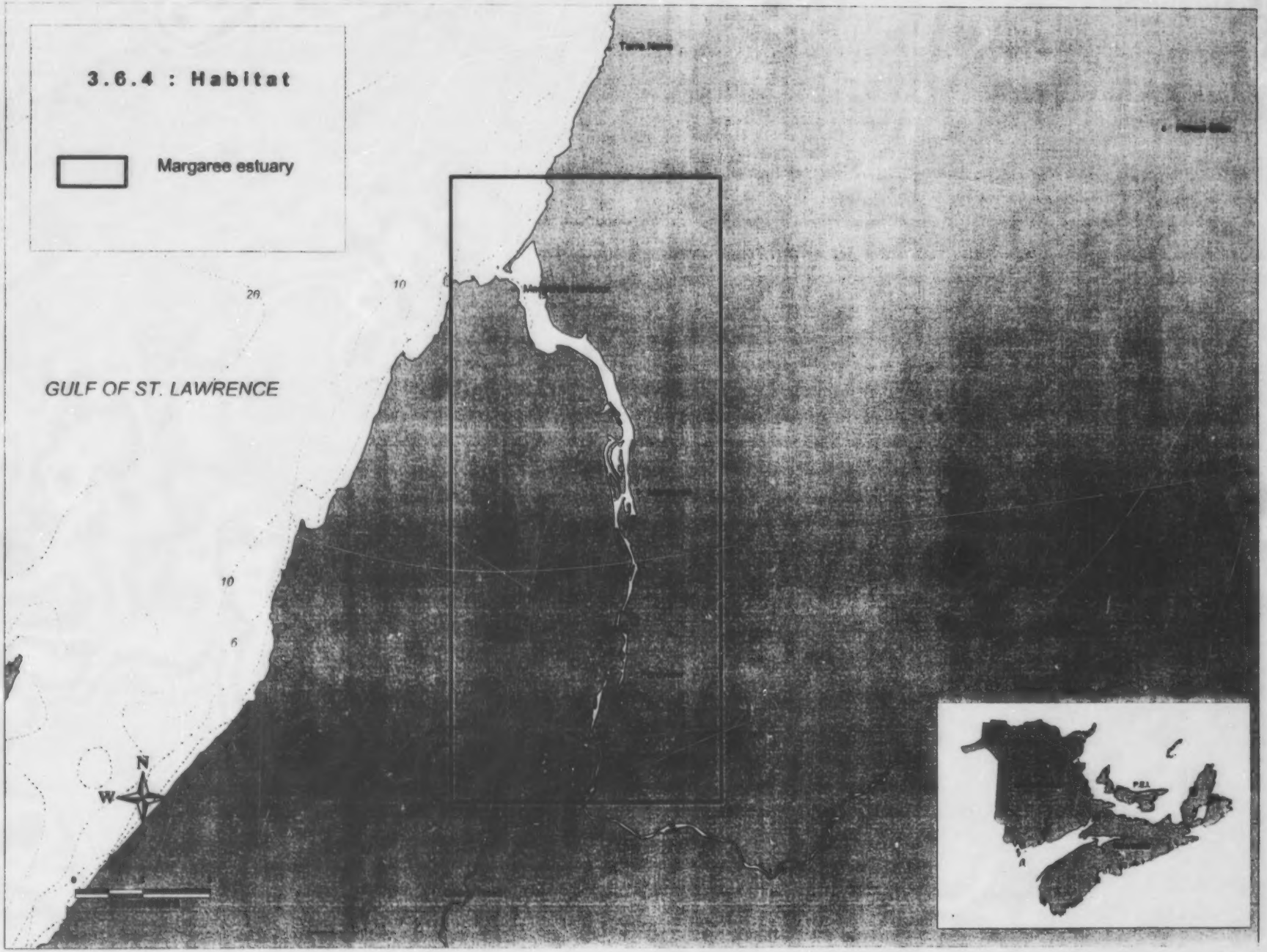
- Margaree Harbour is considered a significant habitat for several species of fish, and molluscs, although no specific fact sheet has been done in this report.

References

E12: Davis et al., 2000, and several authors cited within

E15: A. LeBlanc, p.c. 2001

E16: K. Davidson, p.c. 2001


3.6.4 : Habitat
Margaree estuary
GULF OF ST. LAWRENCE
20
10
10
6
N
W

3.6.5 Cape Breton trough

Ecological Features

- Cape Breton trough is an aquatic habitat on the west shore of Cape Breton (figure 3.6.5). The limits of the area are approximate and roughly follow the 70 m depth isobath.
- The trough is the deepest water region in the study area (>70m bathymetric contour). It is the only area reaching the depth of the Laurentian channel (>100 m). The 100 m contour outlines the deeper Laurentian channel and was likely caused by the retreat of the continental ice field that spanned North America 15,000-10,000 years ago. [e17]
- Because of its depth, the trough is the only area in the Southern Gulf where the three layers of water found in the Laurentian channel can be clearly identified : (1) a warm, relatively fresh surface layer, (2) a cold intermediate layer and (3) a warm, relatively salty deeper layer.
- The trough is an area of upwelling, where the deeper, colder and richer layer of water is pushed towards the surface against an abruptly rising sea floor. This is similar to what is observed at the upstream end of the Laurentian channel at the confluence of the Saguenay River in the St. Lawrence estuary. The ensuing richness of the area (wildlife density and diversity) may be among the reasons why it is used as a migratory path by most of the species coming in and out of the Gulf annually. The water depth, stratification and the presence of an upwelling make the trough unique in the Southern Gulf of St. Lawrence.
- The species using the trough as a migration path include cod, herring, mackerel, sharks (porbeagle, mako, blue), squid, bluefin tuna, witch flounder and white hake. [e12,e18-e24]
- The trough is the main feeding area for witch flounder in the Southern Gulf and could also be a potential spawning area although the latter is not proven yet. [e23,e25]
- In recent years, the Cape Breton trough was the area where the higher concentration of some species was observed, notably capelin, white hake (with St. Georges Bay area), plaice, and witch flounder. [e21,e23,e24,e26]
- Deep water species merely not found elsewhere in the Southern Gulf use this area, including smooth skate, and wolffish. [e27,e28]
- High densities of several invertebrates are found in the trough; among these are snow crab, scallops, sea urchins, sea cucumbers, and brittle stars. [e21,e29]
- The trough is harvested for snow crab, scallop, cod, witch flounder, plaice, halibut, and white hake. [e5] Besides these, several species less abundant are caught as by-catch, notably wolffish. [e27] Between the trough and the coast of

Cape Breton, other species including rock crab, toad crab, lobster are also harvested. [85]

- Numerous species of marine mammals are observed in the trough area and some of them can be watched all year long. The area is home to four species of whale (pilot, minke, fin, and humpack), four species of seal (harbour, grey, harp, hooded), and the orcas, white-sided dolphins, and harbour porpoises. [s12,s21,s30,s33]

Vulnerability, threats and human pressure

- Any alteration of habitat in that area could have an impact on the migration path of several species. The consequences could include a minor shift in the route taken to a major change in area of high concentrations, which could be detrimental to both the species and the fisheries.
- A modification of the bottom in the trough could affect the potential spawning ground of witch flounder.
- The trough is a complex ecosystem with the presence of almost all the fish species of the Gulf in substantial densities at some time during the year, and any modification could lead to changes in the fish, invertebrate or mammal behaviour in an impredictible way, with possible impact on migration, and biomass (long term).

Socio-economic characteristics

- Species caught in northern Cape Breton represent a higher diversity than elsewhere in the Southern Gulf. It is one of few areas where the value of the lobster fishery falls in second place. The importance of the snow crab fishery to this region is the best example. A deeper water species, snow crab outperforms lobster in landed value data for district 2. This is an anomaly in gulf N.S. and P.E.I. (the only other exception to the dominance of lobster is oyster in P.E.I. districts 83 and 85).
- Thirty-one species are listed for landings in district 2 and twenty-two are listed for district 1 in 1999 landing data. The only other districts that share a similar composition are those of the eastern and western ends of P.E.I. (87,88, 92, and 95). In the central districts of N.S. and P.E.I, nine to twelve species are listed, with an important contribution of bivalves; this differs greatly from the composition of species in the trough area. The landed weight may seem insignificant for some species, but their inclusion in the overall picture highlights the diversity of species.
- The Cheticamp area has been an historic port for landing groundfish since the early days of the colony. It usually falls in the five major ports in both total landed weight and total landed value for the entire gulf region, although it is usually preceded by the Caraquet peninsula area of N.B. [s32]

- The frequency of whale sightings in the Cheticamp and Pleasant Bay areas has encouraged a burgeoning whale watching tourism market. This market is mostly served by fishing captains who bring tour boats to the whales; this is usually a summer activity that is subsequent to the lobster season.
- Cape Breton is a popular tourist destination with spectacular geological formations and breathtaking vista. In addition to fishing, tourism is the main economical contributor to the local economy.

Support, favourable and unfavourable factors

- Migratory corridor for many species, this is noted as an area of high productivity and diversity for the Southern gulf of St. Lawrence.
- An important habitat and migration route for recovering groundfish stocks.
- Integrated effort within Mi'kmaq, Acadian and Gaelic coastal communities to sustain the century-old fishing industry.
- Petroleum interests have a portion of the area leased, with plans to explore for oil and gas resources.

Other associated significant habitats

- Cape Breton Trough is considered a significant habitat for several species of fish, invertebrates and marine mammals, although only one fact sheet has been done on one of them in this report: bluefin tuna (3.2.14).

References

E5: MacNeil, J.L. & Assoc., 1998

E12: Davis et al., 2000, and several authors cited within

E17: Stea, R. and R. Mott (1998)

E18: Campana et al., 1999

E19: LeBlanc et al., 2001

E20: DFO (mackerel), 2001e

E21: Several participants to the significant habitat workshop (see appendix)

E22: Clay and Hurlbut, 1988

E23: Swain and Poirier, 2001

E24: Poirier et al., 2000

E25: D. Swain, p.c. 2001

E26: DFO (capelin), 2001d

E27: McRuer et al., 2000

E28: Clay, 1991

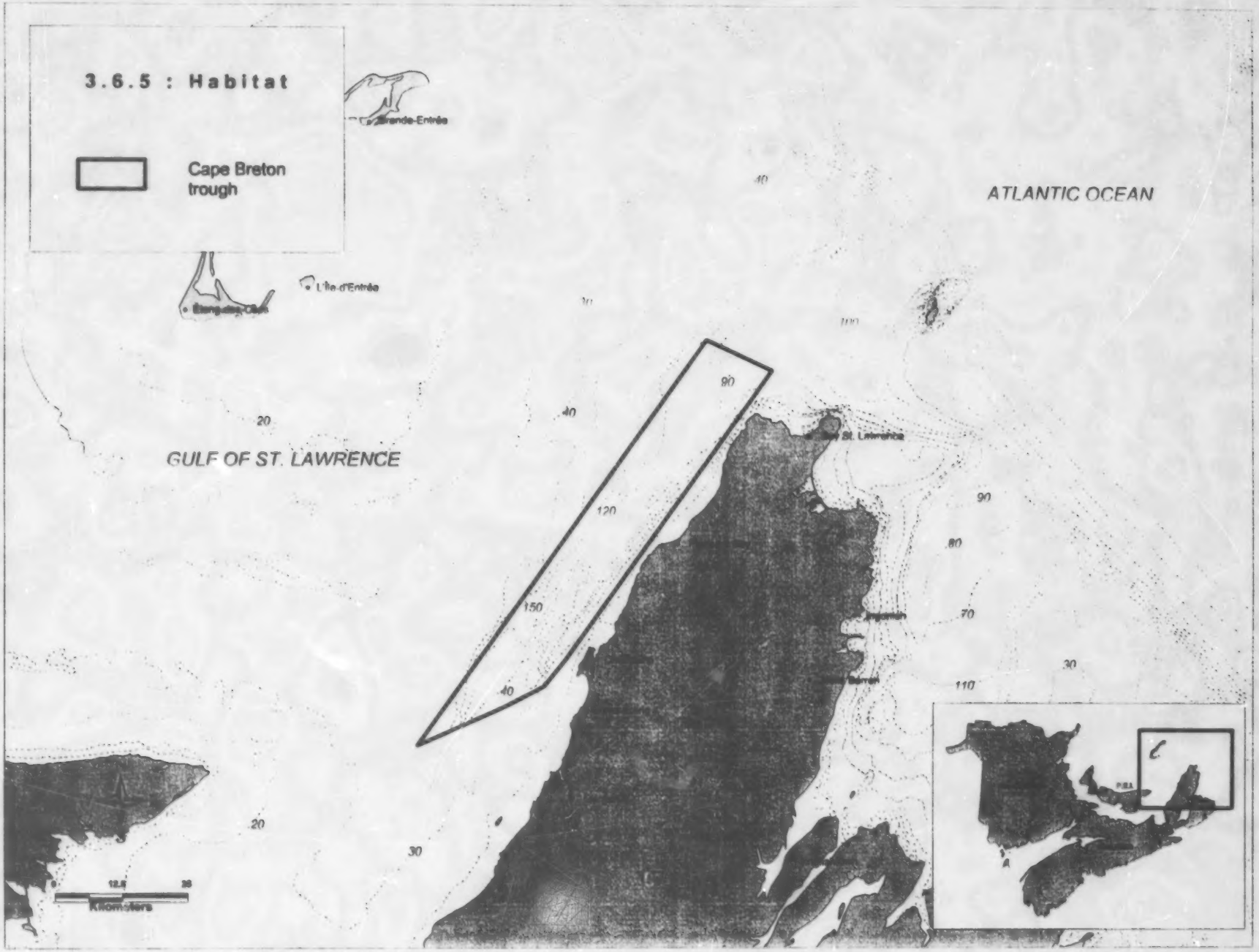
E29: Hébert et al., 2000

E30: Atlantex Limited, 1994

E31: G. Chouinard, p.c. 2001

E32: DFO (Overview of the Gulf Region), 1998d

E33: Kingsley and Reeves, 1998


3.6.5 : Habitat
Cape Breton trough
ATLANTIC OCEAN
GULF OF ST. LAWRENCE
L'Ile d'Entrée
20
40
90
120
150
30
70
80
110
Kilometers

3.6.6 Fisherman's Bank

Ecological Features

- Fisherman's Bank is an aquatic habitat on the east shore of P.E.I. (figure 3.6.6).
- Fisherman's Bank measures about 16,5 km^2 at a depth varying from 9 to 20 m. [e30] It is surrounded by deeper water except on its northeast edge which is more elongated and forms "The Ridge", with an average depth of 24-32 m. The dominant substrate is cobble, with sand and gravel present at the edge of the bank. [e30]
- Fisherman's Bank and The Ridge are known for their high productivity for a number of aquatic resources. This site is one of the main fall-spawning herring areas near the Gulf coast of N.S. and around P.E.I. (fact sheet 3.2.4). [e31,e32] Fish species, including mackerel, witch flounder, cunner and several others who feed on herring eggs, and bluefin tuna who feed on these fish are also in high densities in the area. [e31,e32] Concentrations of minke whale have also been observed feeding in the area. [e32]
- The surrounding area is harvested for lobster, rock crab, mackerel, and herring. [e5] It was also harvested for scallop before the creation of a larger buffer zone, which include Fisherman's Bank, where the use of drag for scallop fishing is not allowed.

Vulnerability, threats and human pressure

- Since 1999, there has been a buffer zone from East Point to Hillsborough Bay on the east coast of P.E.I., including Fisherman's Bank (see map in appendix). Fishermen are not allowed to drag for scallops in this area.
- Fisherman's Bank and the Ridge are specific ocean habitats. These two areas are offshore between P.E.I., northeast N.S., and Cape Breton. Marine environmental quality is considered to be good.

Socio-economic characteristics

- Fisherman's bank is one of several important bank areas in the eastern Northumberland Strait. The other banks of local prominence are Henry's Bank, The Ridge, and the area around Pictou Island (fact sheet 3.6.2).
- The most dominant fishery on the bank is the autumn herring roe fishery (fact sheet 3.2.4). Bluefin tuna is also of economic importance. Most of the Herring Fishing Area (HFA) 16G activity is carried out by P.E.I. license holders (378). There are 18 licenses registered in N.S. for HFA16G.

- The variability in the tuna fishery dictates that there is a greater diversity of license holders active on the bank, they may be from a variety of gulf areas, depending on the location of tuna in a given year.
- Important commercial species in statistical districts 87 and 88 are (1999 landed value order over $100,000):

Species	Value ($000)	Licenses (valid)	Season
Lobster (LFA 26A)	34,755	577	May 1- June 30
Mussel	6,695	32	Summer (wild) Year round (aquaculture)
Herring	2,122	378	Aug.-Sept.
Cod (3PN, 4R, 4T, 4S, 4VN)	764	416	Varies
Bluefin Tuna	686	219	Aug.- Nov.
Snow Crab	546	4	July- Sept.
Rock Crab (LFA 26A)	402	15	Aug. 9-Nov 9. (1999)
Softshell Clam	387	286	Summer
Silverside	359	27	
American Plaice (3PN, 4R, 4T, 4S, 4VN)	330	416	Varies
Mackerel	277	573	May – Aug.

Support, favourable and unfavourable factors

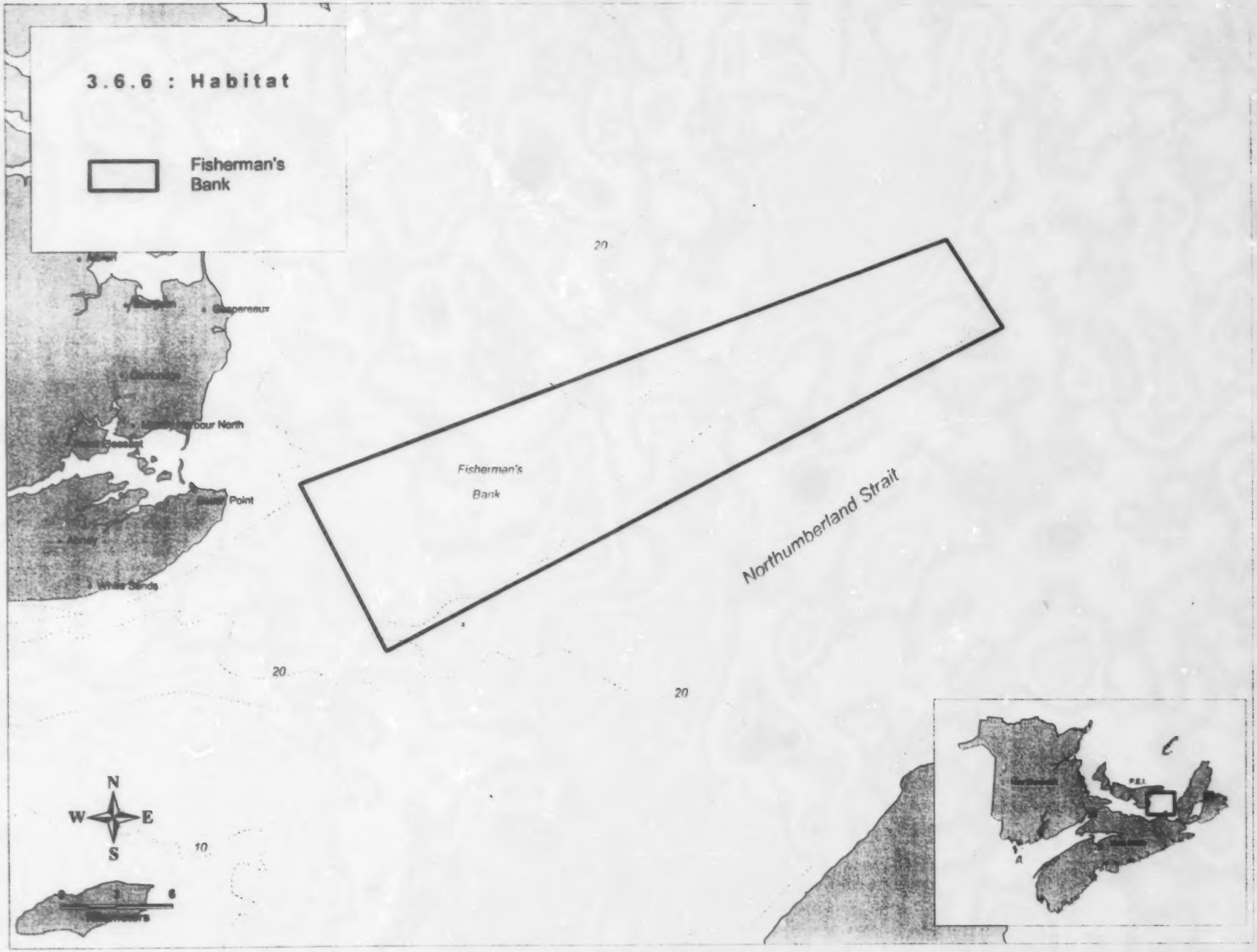
- Fisherman's Bank and the Ridge are known for their high productivity for several aquatic resources, including several commercially harvested species.
- Fisherman's Bank is the site of one of the P.E.I. and Gulf N.S. region's largest concentration of spawning herring.
- The buffer zone restricting scallop drag fishing, which include Fisherman's Bank, was implemented in 1999 from a mutual agreement between fishers, which shows their concern about resource conservation and habitat protection.
- An area important to a multitude of species. This area warrants an ecosystem management approach.

Other associated significant habitats

- Fisherman's Bank constitute a significant habitat included in fact sheets for: herring (3.2.4, 3.2.5), bluefin tuna (3.2.14), and grey seal (3.5.1).

References

E5: MacNeil, J.L. & Assoc., 1998
E30: Cairns et al., 1996
E31: C. LeBlanc, p.c. 2001
E32: D. Cairns, p.c., 2001


3.6.6 : Habitat
Fisherman's Bank
Fisherman's Bank
Northumberland Strait
20
20
20
10
N
W
E
S
Point
White Sands
PEI

3.6.7 Basin Head

Ecological Features

- Basin Head is shallow coastal lagoon located on the east coast of P.E.I. (figure 3.6.7). It covers 60 ha.
- Extensive dune system and agricultural land surround the lagoon.
- The area supports different kind of aquatic plants, including, in rank of total biomass, eelgrass, sea lettuce and Irish moss. [e33,e34] The latter is most notable, as it is a unique strain that is not found elsewhere in the world. [e33] It differs from other strains because it is significantly larger, free-floating, and has a higher and purer concentration of carrageenan, a thickening agent.
- Different invertebrates are found in the area, the most abundant being an amphipod and a gastropod, with the presence of mussel, softshell clam and periwinkle. [e34,e35]
- The primarily fish species in the lagoon are brook trout, eel, and smelt. [e35]
- The area is also used by migrating waterfowl. [e35]

Vulnerability, threats and human pressure

- Dredging of the channel has occurred in the past. «*While the eastern outlet for the lagoon may have naturally filled with sand, local residents recount dredging of the present day channel circa 1940, and intentional infilling of the historical channel at that time. Given the frequency with which today's channel has had to be re-dredged over the years, some have said 'they cut the wrong end'.*» [e35]
- Promotion of the area as a nature preserve and marine protected area may increase the amount of visitors per year. This, of course, is the goal of any such program. However increased numbers of people using the habitat, even benign activities such as canoeing and kayaking, may have unintended consequences. Increased load on septic fields in campgrounds and area hotels. Increased traffic on the dune environment that surrounds the outer area of the lagoon.
- Agricultural runoff and siltation in the fields adjacent the area have been suggested as a problem, however, soil conservation measures such as terracing and grassed waterways are used to reduce this effect. Faecal coliform contamination closed the softshell clam harvest in the summer of 1999. There is a small cottage development approximately 1 km from the lagoon.
- Recent concern for the eel population has been expressed in the community; measures to reduce fishing effort have been discussed.

- Green crab, an introduced European species has been identified in Basin Head. This species is know to have a considerable impact when it invades new areas as it has no natural predators and consumes large volumes of shellfish. [e37]

Socio-economic characteristics

- Located on the Southeast coast of P.E.I., the economy of the area around Basin Head is rural in nature. Agricultural land (750 ha.) surrounds the inland lagoon area, sand dunes the outer area (319ha.).
- Agriculture, fishing, and tourism are the main components of the region. Tourism is estimated to generate $12M to the economy of Eastern Kings tourism region.
- Softshell clam is the only commercial harvest currently taking place in the lagoon. Eel, smelt, and Irish moss were commercially harvested in the past, but this no longer occurs. Commercial fishing takes place at the nearby ports of Souris and North Lake.

Support, favourable and unfavourable factors

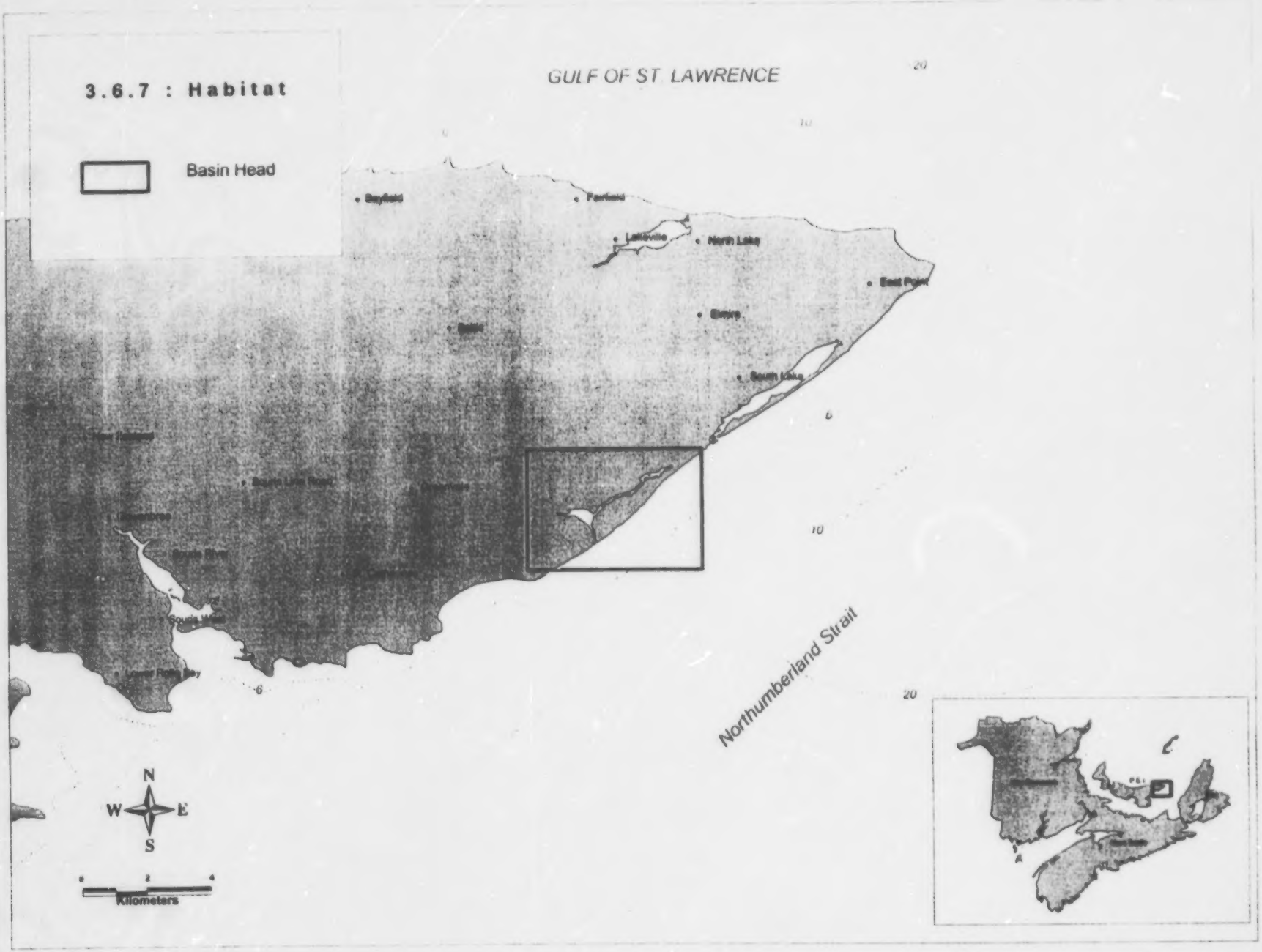
- This site was an early pilot project in the Ocean's Act Marine Protected Areas Program and is designated as an *Area of Interest* (AOI).
- Integrated Management efforts are being carried out in partnership with the Basin Head Lagoon Ecosystem Conservation Committee (BHLECC), the P.E.I. Dept. of Fisheries & Aquaculture & Environment, and the P.E.I. Museum & Heritage Foundation. This project is also recieving support from the P.E.I. Marine Conservation Areas Committee.
- Further research in the area on water quality condition and optimum standards for marine plant communities will lead to the development of specific Marine Environmental Quality guidelines for the Lagoon.

Other associated significant habitats

- Basin Head is considered a significant habitat for a unique strain of Irish moss. It is also associated with the Irish moss (3.1.2) fact sheet in this report.

References

E33: Boyd and Smith, 2000
E34: Sharp and Semple, 1999
E35: Island Nature Trust, 2001
E37: A. Locke, p.c. 2001


3.6.7 : Habitat
Basin Head
GULF OF ST. LAWRENCE
Bayfield
Pictou
Lakeville
North Lake
East Point
Elmira
Souris
Souris Lake Road
Souris River
Souris West
Lower Rollo Bay
Northumberland Strait
N
W
E
S
Kilometers

4. CONCLUSION

The review of regionally significant habitats on the Gulf coast of Nova Scotia and around Prince Edward Island identified 29 major species-habitat associations and 7 habitats described in detailed fact sheets in chapter 3. Another 31 habitats not fully described but simply located on 10 maps presented in the appendices complete the information.

Again, it should be mentioned that this review is not exhaustive, since the level of available information varies considerably, both spatially and according to species. It would have been preferable to clearly identify particular areas essential to non-harvested species in addition to the harvested ones. It should also be understood that the purpose of this report was not to identify all the marine habitats used by living resources, only key ones. It is the major reason why all the coastal habitats used seasonally by some ubiquitous species, lobster being a good example, are not pointed out in the fact sheets.

However, this review is representative of what is generally known about aquatic resources in that region. It provides an overview that may be useful for habitat protection, management, and resource allocation or for the establishment of a new status (e.g. Marine Protected Area), or new management methods (e.g. integrated management). In addition to the areas presented on maps, all the estuaries and the known location of two cyclonic gyres at both ends of the Northumberland Strait should be considered significant.

This report is a tool that, in case of specific projects or impact assessments, should be complemented by reading the references cited for each habitat, the associated research reports, status reports and landings statistics available since its publication. Some reports in progress unavailable at the time of completion, notably for bluefin tuna and Irish moss, would shed more light on what is presented here.

5. REFERENCES

ATLANTEX LIMITED. 1994. Whale Interpretation Centre. Preliminary Feasibility Analysis. Prepared for Pleasant Bay Development Association. 54 p.

BECK, B. 1983. Le phoque gris de l'est du Canada. Le monde sous-marin. Ministère des Pêches et des Océans. Fs 41-33/26-1983F.

BELL. W. 1990. La mousse d'Irlande. Le Monde sous-marin. Ministère des Pêches et des Océans. Fs 41-33/9-1990F.

BOWEN, W.D. 1991. The Harp Seal. Underwater World. Department of Fisheries and Oceans Marine Fish Division. 8 p.

BOYD, P. and B. SMITH. 2000. Working Together to Conserve and Protect a Unique Ecosystem; Basin Head Prince Edward Island. In S.Bondrup-Neilsen et al. (editors), Protected Areas in a Changing World, SAMPAA, Wolfville, N.S., Canada.10 p.

CAIRNS, D.K. 1995. Herring spawn volume at Fisherman's Bank, Prince Edward Island, in 1994. DFO Atlantic Fisheries Res. Doc. 95/121.

CAIRNS, D.K. 1997. A Biological Review of Commercial Diadromous Fishes of Prince Edward Island. DFO Can. Stock Ass. Sec. Res. Doc. 97/74.

CAIRNS, D.K., KEEN, D.M., DAOUST, P.-Y., GILLIS, D.J. and M.O. HAMMILL. 2000. Conflicts between seals and fishing gear on Prince Edward Island. Can. Tech. Rep. Fish. Aquat. Sci. nº 2333. 39 pp.

CAIRNS, D.K., LEBLANC, C. and C. MacDOUGALL. 1996. Herring spawn volume and progenitor biomass at Fisherman's Bank, Prince Edward Island, in 1995. DFO Atlantic Fisheries Res. Doc. 96/121.12 p.

CAIRNS, D.K., MESSIEH, S.N., WADE, E., MacPHERSON, P.A. and G.C.J. BOURQUE. 1993. Timing, location, and volume of herring spawn deposition at Fisherman's Bank, Prince Edward Island, 1987-1990. Can. Tech. Rep. Fish. Aquat. Sci. nº 1928.

CAMPANA, S.E., CHOUINARD, G.A., HANSON, J.M. and A. FRÉCHET. 1999. Mixing and migration of overwintering Atlantic cod (Gadus morhua) stocks near the mouth of the Gulf of St.Lawrence. Can. J. Fish. Aquat. Sci. 56 :1873-1881.

CHOUINARD, G.A., CURRIE and G.A. POIRIER. 2001. Assessment of cod in the Southern Gulf of St.Lawrence, February 2001. DFO Can. Stock Ass. Sec. Res. Doc. 2001/020.

CHOUINARD, G.A., CURRIE, L.G., SINCLAIR A.F., POIRIER, G.A. and D.P. SWAIN. 2000. Assessment of cod in the Southern Gulf of St.Lawrence, February 2000. DFO Can. Stock Ass. Sec. Res. Doc. 2000/019.

CHOUINARD, G.A., HANSON, J.M. and G.A. NIELSEN. 1991. Definition of juvenile areas for the 4T-Vn (January-April) cod stock. CSCPCA/CAFSAC Res. Doc. 91/6.

CHOUINARD, G.A., NIELSEN, G.A., CURRIE, L.G. and J.P. MURPHY. 1990. Stock status of the southern Gulf of St. Lawrence cod stock (4T and 4Vn (Jan.-Apr.)) in 1990. CSCPCA/CAFSAC Doc. Rech. 90/46

CHOUINARD, G.A., POIRIER, G.A., SWAIN, D.P., HURLBUT, T. and R. MORIN. 1998. Preliminary Results from the September 1998 Groundfish Survey in the Southern Gulf of St. Lawrence, Department of Fisheries and Oceans. CSCPCA/CAFSAC Res. Doc 98/142.

CHOUINARD, G.A. and A.F. SINCLAIR. 1989. Assessment of the 4T-Vn (Jan.-Apr.) cod stock for 1989. CSCPCA/CAFSAC Doc. Rech. 89/51

CLAY, D. 1991. « Seasonal distribution of demersal fish (Osteichthyes) and skates (Chrondrichthyes) in the southeastern Gulf of St.Lawrence, » Can. Spec. Publ. Fish. Aquat. Sci. 113 :241-259.

CLAY, D. and T. HURLBUT. 1988. Le thon rouge. Le Monde sous-marin. Ministère des Pêches et des Océans. Fs 41-33/55-1988F.

DAVIS, A., KELLMAN, L., RUSESKI, G., WILLIAMS, J., CAMERON, C., MITCHELL, S., EDWARDS, C. and D. SPENCER. 2000. St.Georges Bay Ecosystem project (GBEP) : Research report I. Document prepared by the Interdisciplinary studies in aquatic Resources, St.Francis Xavier University, Antigonish Nova Scotia for Fisheries and Oceans Canada, Can. Manuscr. Rep. Fish Aquat. Sci. 2511, 293 pp + Appendix.

DE LAFONTAINE, Y., S. DEMERS, and J. RUNGE. 1991. Pelagic food web interactions and productivity in the Gulf of St. Lawrence: a perspective, p. 99-123. In: J.-C. Therriault [ed.] The Gulf of St. Lawrence: small ocean or big estuary? Can. Spec. Publ. Fish. Aquat. Sci. 113.

DEPARTMENT OF ENVIRONMENT CANADA. 2000. Biodiversity portrait of the St.Lawrence. Canadian Wildlife Service, Quebec Region. 1 August 2000. Web site :http://www.qc.ec.gc.ca/faune/biodiv/en/table_contents.html

DEPARTMENT OF FISHERIES AND AQUACULTURE. 1991. Fisheries Statistical Review. P. 7

DEPARTMENT OF FISHERIES AND OCEANS (DFO). 1996a. Southern Gulf Surf Clam. DFO-Science, Stock Status Report 96/101E.

DEPARTMENT OF FISHERIES AND OCEANS (DFO). 1996b. Southern gulf Northern Quahaug, DFO-Science, Stock Status Report 96/102E.

DEPARTMENT OF FISHERIES AND OCEANS (DFO). 1996c. Southern Gulf American Oyster. DFO-Science, Stock Status Report 96/105E.

DEPARTMENT OF FISHERIES AND OCEANS (DFO) 1998a. Sites d'intérêt identifiés en vue de la désignation d'éventuelles zones de protection marines pilotes. Ministère des Pêches et des Océans, région Laurentienne. Document de travail. 44 p.

DEPARTMENT OF FISHERIES AND OCEANS (DFO). 1998b. Lobster (LFA 23, 24, 25, 26A and 26B). DFO-Science, Stock Status Report .C3-12(1998).

DEPARTMENT OF FISHERIES AND OCEANS (DFO). 1998c. Southern gulf of St. Lawrence Sea Scallop. DFO-Science, Stock Status Report C3-16(1998).

DEPARTMENT OF FISHERIES AND OCEANS (DFO). 1998d. Overview of Gulf region. DFO-Science, Stock Status Report G1-01(1998).

DEPARTMENT OF FISHERIES AND OCEANS (DFO). 2000a. Commercial Lobster Fishery Profile. Gulf Region Policy and Economics Branch.

DEPARTMENT OF FISHERIES AND OCEANS (DFO). 2000b. Harp seal. DFO-Science, Stock Status Report .E1-01(2000).

DEPARTMENT OF FISHERIES AND OCEANS (DFO). 2001a. Cod in the sourthern Gulf of St. Lawrence. DFO-Science, Stock Status Report A3-01(2001).

DEPARTMENT OF FISHERIES AND OCEANS (DFO). 2001b. White hake in the sourthern Gulf of St. Lawrence. DFO-Science, Stock Status Report A3-12(2001).

DEPARTMENT OF FISHERIES AND OCEANS (DFO). 2001c. Southern Gulf of St. Lawrence Herring. DFO-Science, Stock Status Report B3-01 (2001).

DEPARTMENT OF FISHERIES AND OCEANS (DFO). 2001d. Capelin in the Estuary and Gulf of St. Lawrence. DFO-Science, Stock Status Report B4-03 (2001).

DEPARTMENT OF FISHERIES AND OCEANS (DFO). 2001e. Mackerel in the northwest Atlantic. DFO-Science, Stock Status Report B4-04 (2001).

DEPARTMENT OF FISHERIES AND OCEANS (DFO). 2001f. Atlantic Seal Hunt – 2000 Management Plan. Resource Management-Atlantic. DFO/6124. Web site : www.ncr.dfo.ca/seal-phoque/reports/MgtPlan 2000/sect0.htm

DUPUIS, H.M.C., COURTENAY, S.C. and E.M.P. CHADWICK. 1997. Distribution of juvenile Atlantic herring in the southern Gulf of St. Lawrence. Can. Tech. Rep. Fish. Aquat. Sci. 2141:19 p.

EATON, P.B., GRAY, A.G., JOHNSON, P.M. and E. HUNDERT. 1994. State of the Environment in the Atlantic Region. Environment Canada, Dartmouth, 502 p.

ENVIRONMENT CANADA. 1990. A profile of important Estuaries in Atlantic Canada. Environment Canada, Environmental protection, Atlantic Region. Dartmouth, Nova Scotia.

FISHERIES RESOURCE CONSERVATION COUNCIL – A Conservation Framework for Atlantic Lobster. FRCC95.R.1. Supply and Services Canada, Cat. No. FS23-278/1995.

GOULET, A.-M. 1996. Caractérisation des déplacements et des activités de plongée du phoque gris (Halichoerus grypus) dans le golfe du Saint-Laurent par la télémétrie par satellite. Mémoire de maîtrise (M.Sc.), Département de Biologie. Université Laval. Ste-Foy, Québec.

GRÉGOIRE, F., MORRIER, G., LÉVESQUE, C. et J. HUDON. 2001. État du stock de maquereau bleu (Scomber scombrus L.) des sous-régions 3-4 de l'OPANO pour 2000. Secrétariat canadien de consultation scientifique. Document de recherche 2001-081.

GRÉGOIRE, F., POIRIER, G., CHOUINARD, G. and C. LÉVESQUE. 1997. Capelin (Mallotus villosus) by-catches, landings and abundance in the Estuary and Gulf of St. Lawrence. Department of Fisheries and Oceans, CSCPCA/CAFSAC Res. Doc 97/122.

HAMMILL, M.O. 1999. Replacement Yields of Northwest Atlantic Grey seals (Halichoerus grypus). WP99/11 presented at the National Marine Mammal Peer Review Meeting in Montreal, 1-5 February 1999. 16 p.

HAMMILL, M., GOSSELIN, J.F., PROUST, F. and D. CHABOT. 1999. A review of information relevant to the issue of consumption of Atlantic cod (Gadus morhua) by seal species in the southern Gulf of St.Lawrence. DFO Can. Stock Ass. Sec. Res. Doc. 99/070. 25 p.

HAMMILL, M.O. and G.B. STENSON. 1997. Estimated prey consumption by harp seals (Phoca groenlandica), grey seals (Halichoerus grypus), harbour seals (Phoca vitulina) and hooded seals (Cystophora cristata). NAFO SCR Doc. 97/40. 37 p.

HAMMILL, M.O. and G.B. STENSON. 2000. Estimated Prey Consumption by Harp seals (Phoca groenlandica), Hooded seals (Cystophora cristata), Grey seals (Halichoerus grypus) and Harbour seals (Phoca vitulina) in Altantic Canada. J. Northw. Atl. Fish. Sci. Vol. 26 1-23.

HANSON, J. M. 1996. Seasonal distribution of juvenile Atlantic cod in the southern Gulf of St. Lawrence. Journal of Fish Biology 49:1138-1152.

HANSON, J.M. 2001. Pre-fishery abundance and distribution of American lobster in western Northumberland Strait, 1999 and 2000. DFO Can. Stock Ass. Sec. Res. Doc.2001/079.

HAWKINS, C.M. and T.W. ROWELL. 1985. Population Survey of the Oyster Crassostrea virginica in the Dunk River Estuary, Prince Edward Island, 1977. Can. Man. Rep. of Fish. and Aquat. Sci. N• 1863.

HÉBERT, M., HÉBERT, A., WADE, E., SURETTE, T., GIARD, D., DeGRÂCE, P., BIRON, M and M. MORIYASU. 1999. The 1999 assessment of snow crab, Chionoecetes opilio, stock in the southwestern Gulf of St.Lawrence (Areas 12-25/26, E and F). DFO Can. Stock Ass. Sec. Res. Doc. 2000/014. 57 p.

HURLBUT, T. and G. POIRIER. 2001. The Status of White Hake (Urophycis tenuis Mitchill) in the southern Gulf of St.Lawrence (NAFO Division 4T) in 2001. DFO Can. Stock Ass. Sec. Res. Doc. 2001/024.

HURLBUT, T., POIRIER, G. and G. CHOUINARD. 1998. The Status of White Hake (Urophycis tenuis, Mitchill) in the Southern Gulf of St. Lawrence (NAFO Division 4T) in 1997. DFO, CSCPCA/CAFSAC Res. Doc 98/01.

INNIS, H.A. 1954. The Cod Fishery: The History of an International Economy University of Toronto Press, Toronto

INTERNATIONAL COMMISSION FOR THE CONSERVATION OF ATLANTIC TUNAS (ICCAT). 2000. Executive summary of Bluefin Tuna.

ISLAND NATURE TRUST, 2001. Community use of the Basin Head Lagoon, Prince Edward Island. March, 2001.

J. LEE MacNEILL & ASSOCIATES. 1998. Resource Mapping Series. Traditional Fisheries Knowledge for the Southern Gulf of St. Lawrence. Department of Fisheries and Oceans, Moncton. Atlas.

J. LEE MacNEILL & ASSOCIATES. 2001. Resource Mapping Series. Traditional Fisheries Knowledge for the Southern Gulf of St. Lawrence – Inshore Resources. Department of Fisheries and Oceans, Moncton. Atlas. (in prep.)

JAMIESON, G.S., ETTER, M. and R.A. CHANDLER. 1981. The effects of scallop fishing on lobsters in the western Northumberland Strait. Department of Fisheries and Oceans, Halifax, Research document 81/71, 19p.

JENKINS, J.B., MORRISON, A. and C.L. Jr. MacKENZIE. 1997. The Molluscan Fisheries of the Canadian Maritimes. NOAA Technical Report NMFS 127.

KINGSLEY, M.C.S. and R.R. REEVES. 1998. Aerial surveys of cetaceans in the Gulf of St.Lawrence in 1995 and 1996. Can. J. Zool. 76 :1529-1550.

KOUTITONSKI, V. G. and G. L. BUGDEN. 1991. The physical oceanography of the Gulf of St. Lawrence: a review with emphasis on the synoptic variability of the motion, p. 57-90. In: J.-C. Therriault [ed.] The Gulf of St. Lawrence: small ocean or big estuary? Can. Spec. Publ. Fish. Aquat. Sci. 113.

KRAUEL, D.P. 1969. Tidal flushing of Pictou Harbour and Pictou Road, NS. Fish. Res. Bd. Can. Tech. Rept. 146. 28 p.

LANDRY, T., HARDY, M., OUELLETTE, M., MacNAIR, N.G. and A. BOGHEN. 1999. Reproductive Biology of the Northern Quahaug, Mercenaria mercenaria, in Prince Edward Island. Cana. Tech. Rep. of Fish. and Aquat. Sci. 2287.

LANTEIGNE, M., COMEAU, M., MALLET, M., ROBICHAUD, G. and F. SAVOIE. 1998. The American Lobster, Homarus americanus, in the southern Gulf of St. Lawrence (Lobster Fishing Areas 23, 24, 25, 26A et 26B). CSCPCA/CAFSAC Res. Doc 98/123.

LANTEIGNE, M., DAVIDSON, L.A. and J. WORMS. 1986. Status of the Southern Gulf of St.Lawrence scallop stocks. CAFSAC Research Document 87/84.

LEBLANC, C.H., CHOUINARD, G.A. and G.A. POIRIER. 2001. Assessment of the 4T southern Gulf of St.Lawrence herring stocks in 2000. DFO Can. Stock Ass. Sec. Res. Doc. 2001/045.

LEBLANC, C., MELLO, L. and H.M.C. DUPUIS. 1997. Analysis of juvenile Atlantic herring catches in the southern Gulf of St. Lawrence September groundfish surveys. Can. Tech. Rep. Fish. Aquat. Sci. 2185:31 p.

LEBLANC, C.H., MELLO, L. and H.M.C. DUPUIS. 1998. Juvenile Atlantic herring 1991 to 1995 December bottom-trawl survey results in the southern Gulf of St. Lawrence. Can. Tech. Rep. Fish. Aquat. Sci. 2244.

MANSFIELD, A.W. 1988. The Grey Seal. Underwater World. Department of Fisheries and Oceans Marine Fish Division. 12 p.

MARITIMES TESTING (1985) LTD. 1987. A study to identify Marine Natural Areas of Canadian Significance in the Magdalen Shallows Marine Region. Unpublished report prepared by Parks Canada.

McCRACKEN, F.D. Ed. 1979. Canso Marine Environment Workshop part 1 of 4 parts. Executive Summary. Fisheries & Marine Service Technical Report 834.

McKENZIE, R. A. 1959. Marine and freshwater fishes of the Miramichi River and estuary, New Brunswick. J. Fish. Res. Board Can. 16 : 807-833.

McRUER, J., HURLBUT, T. and B. MORIN. 2000. Status of Atlantic Wolffish (Anarhichas lupus) in the Maritimes (NAFO Sub-Area 4 and 5). DFO Can. Stock Ass. Sec. Res. Doc. 2000/138. 57 p.

MURRAY, D. 1999. A comprehensive Report on the Giant Scallop (Placopecten magellanicus). Summary of the Scallop Fishery on the New Brunswick Coast. Scallop Enhancement in Atlantic Canada, BPFA.

NAFO, 2000. Statlant data series 21A

O'DRISCOLL, R.L., ROSE, G.A., ANDERSON, J.T. and F. MOWBRAY. 2000. Spatial association between cod and capelin : a perspective on the inshore-offshore dichotomy. DFO Can. Stock Ass. Sec. Res. Doc. 2001/083.

PAINTER, H. and P. STEWART. 1992. An assessment of the Environmental Quality of Pictou Harbourand Surrounding Watershed. Pictou Harbour Environmental Action Plan.

PERLEY, M.H. 1852. The sea and river: Fisheries of New Brunswick. Report to the House of Assembly, Fredericton.

POIRIER, G.S., CHOUINARD, G.A., SWAIN, D.P., HURLBUT, T., LeBLANC, C. and R. MORIN. 2000. Preliminary results from the September 2000 groundfish survey of the Southern Gulf of St.Lawrence. DFO Can. Stock Ass. Sec. Res. Doc. 2001/135.

PRINGLE, J.D. and R.E. SEMPLE. 1983. A Description of the Major Commercial Irish Moss (Chondrus crispus Stackh.) Beds off Western Prince Edward Island. Can. Man. Rep. of Fish. and Aquat. Sci. 1725.

RASMUSSEN, E. 1977. The wasting disease of Eelgrass (Zostera marina) and its effects on environmental factors and fauna. In: C. P. McRoy and C. Helfferich [ed.] 1977. Seagrass ecosystems, a scientific perspective. Marcel Dekker Inc., NY.

ST-JEAN, S. 2000. Immunological biomarkers of ecosystem health in Pictou Harbour Nova Scotia. Progress report prepared for Environment Canada, Atlantic Region.

ST-JEAN, S.D., COURTENAY, S.C., PELLETIER, É. and R. ST-LOUIS. 1998. Butyltin concentrations in sediments and Blue Mussels (Mytilus edulis) of the Southern Gulf of St.Lawrence, Canada. Environmental Technology. Vol. 20.

SCARRAT, D.J. 1975. Observations on lobsters and scallops near Pictou, N.S. Department of Fisheries and Oceans, Research and Development Branch, St. Andrews, Technical report no 532.

SERGEANT, D.E. 1985. The Hooded Seal. Underwater World. Fisheries and Oceans. 6 p.

SEYMOUR, N.R. 1997 . Distribution, abundance and activity of migrant Canada geese in Antigonish Harbour, Nova Scotia in Erskine, A.J. (ed.) Canada goose studies in the Maritime Provinces, 1950-1992. Environment Canada. Atlantic Region. Occasional Report n° 7. 70-80.

SHARP, G. and R. SEMPLE. 1999. Basin Head Habitat Inventory 1999. Marine Plants Unit Invertebrate Fisheries Division, Dartmouth, N.S. 4 p.

SINCLAIR, A.F. and E. Breen. 1998. Summary of Fisheries in St.Georges Bay. St.Georges Bay Ecosystem Project. Fisheries Science. Web site : http://www.stfx.ca/ people/gbayesp/fsreports.htm

SINCLAIR, A.F., CHOUINARD, G.A. and L.G. CURRIE. 1998. Assessment of Cod in the Southern Gulf of St. Lawrence, January 1998. Department of Fisheries and Oceans. CSCPCA/CAFSAC Res. Doc 98/08.

SOMERS, G., RAYMOND, B. and W. UHLMAN. 1999. PEI Water Quality Interpretive Report". Environment Canada and PEI dept. of Technology and Environment.

STEA, R. and R. MOTT. 1998. Deglaciation of Nova Scotia: Stratigraphy and Chronology of Lake Sediment Cores and buried organic sections. Géographie physique et Quaternaire, 1998, vol. 52, n° 1.

STONE, H.H., ORTIZ, M. and J.M. PORTER. 2000. Updated standardized CPUE indices for canadian bluefin tuna fisheries based on commercial catch rates. DFO Can. Stock Ass. Sec. Res. Doc. 2000/14.

SWAIN, D.P. 1993. Age and density-dependent bathymetric pattern of Atlantic cod (Gadus morhua) in the southern Gulf of St. Lawrence. Can. J. Fish. Aquat. Sci. 50:1255-1264.

SWAIN, D. P. 1999. Changes in the distribution of Atlantic cod (Gadus morhua) in the southern Gulf of St. Lawrence - effects of environmental change or change in environmental preferences? Fish. Oceanogr. 8(1): 1-17.

SWAIN, D.P. and G.A. CHOUINARD. 2000. Background information on the southern Gulf of St.Lawrence cod stock for the Fisheries Oceanography Committee workshop on the cod recruitment dilemma. DFO Can. Stock Ass. Sec. Res. Doc. 2000/142.

SWAIN, D. P. and G. A. POIRIER. 1997. Distributions of Atlantic cod and American plaice during the September 1996 survey of the southern Gulf of St. Lawrence and their relation to historical patterns. Department of Fisheries and Oceans. CSCPCA/CAFSAC Res. Doc 97/66.

SWAIN, D.P. and G.A. POIRIER. 2001. Status of witch flounder in NAFO divisions 4RST, February 2001. DFO Can. Stock Ass. Sec. Res. Doc. 2001/021.

SWAIN, D.P. and A.F. SINCLAIR. 2000. Pelagic fishes and the cod recruitment dilemma in the Northwest Atlantic. Can. J. Fish. Aquat. Sci. 57 : 1321-1325.

SWAIN, D.P., SINCLAIR, A.F., CHOUINARD, G.A. and K.F. DRINKWATER. 2000. Ecosystem effects on pre-recruit survival of cod in the southern Gulf of St.Lawrence. DFO Can. Stock Ass. Sec. Res. Doc. 2001/147.

THERRIEN, J., FRENETTE, I., A. ST.-HILAIRE, FERGUSON, E., BASTIEN-DAIGLE, S and C. GODIN. 2000. Preliminary index of essential habitats for certain marine species of importance in the eastern region of New Brunswick. Document prepared by the Environmental Sciences Research Centre and the K.-C.-Irving Chair in Sustainable Development of the Université de Moncton, for Fisheries and Oceans Canada. Can. Manuscr. Rep. Fish Aquat. Sci. 2510. ix + 202 p.

TREMBLAY, M.J. and M. SINCLAIR. 1995. Gulf of St. Lawrence cod: age specific geographic distributions and environmental occurrences from 1971 to 1981. Can. Tech. Rep. Fish. Aquat. Sci. 1387:43 p.

WATLING, L. and E.A. NORSE. 1998. Disturbance of the Seabed by Mobile Fishing Gear: A Comparison to Forest Clearcutting. Conservation Biology. Vol. 12(6):1180-1197.

WHITE, L. and F. JOHNS. 1997. Marine Environmental Assessment of the Estuary and Gulf of St. Lawrence. Fisheries and Oceans Canada, Dartmouth, Nouvelle-Écosse, Mont-Joli, Québec. 128 p.

WINTERS, G.H. 1978. Production, mortality and sustainable yield of Northwest Atlantic harp seals (Pagophilus groenlandicus). J. Fish. Res. Board Can. 35: 1249-1261.

WORMS, J. 1984. Scallop biomass and density estimates in the Southern Gulf of St.Lawrence. Canadian Atlantic Fisheries Scientific Advisory Committee. CAFSAC Research Document 84/90.

WORMS, J.M. and G. CHOUINARD. 1982. Status of Southern Gulf of St.Lawrence Scallop Stocks. CAFSAC Research Document 83/68.

WORMS, J.M. and G. CHOUINARD. 1983. Status of Southern Gulf of St.Lawrence Scallop Stocks. CAFSAC Research Document 84/57. 48 p.

WORMS, J., LANTEIGNE, M. and L.A. DAVIDSON. 1985. Status of the southern Gulf of St.Lawrence scallop stocks. CAFSAC Research Document 86/55.

APPENDIX A

Supplementary species-habitat
considered as potential significant habitats,
but to a lesser degree.

F3

Appendix A. Supplementary species-habitat considered as potential significant habitats, but to a lesser degree.

Alewife

This species is often regrouped with blueback herring and called gaspereau. Most Southern Gulf of St. Lawrence estuaries can generally be considered migration routes to the Alewife spawning grounds located in fresh or brackish waters. In addition, fish larvae may use the estuaries as nursery areas until they move to the sea. The data available is incomplete but the species is nevertheless likely to be present in all accessible tidal rivers, thus no particular area is mapped.

American eel

The American eel is a catadromous species, thus most estuaries of the Southern Gulf of St. Lawrence are migration routes to feeding and growing habitats located in fresh water. The data available is incomplete but the species is nevertheless likely to be present in all accessible tidal rivers, thus no particular area is mapped.

American lobster

Berried female concentration in Malpeque Bay[A1,A2] (figure 3.3.2).

American shad

Most Southern Gulf of St. Lawrence estuaries can generally be considered migration routes to the shad's spawning grounds located in fresh or brackish waters. In addition, fish larvae may use the estuaries as nursery areas until they move to the sea. The data available is incomplete but the species is nevertheless likely to be present in all accessible tidal rivers, thus no particular area is mapped.

Aquatic birds

Aquatic birds use all the coastal areas and particularly feed on molluscs, small invertebrates, fish and aquatic vegetation, mostly seasonally from spring to fall but also annually for the species that do not migrate to the south. Because of the complexity of the identification of specific areas for given species, no mapping is presented and if further information is needed, it should be gathered directly from the Canadian Wildlife Service or relevant provincial department.

Atlantic herring

Spring-spawning ground from Baie Verte to Amet Sound[A3] (figure 3.2.15). The spring-spawning grounds are generally located at depths of less than 3 fathoms (5 m)[A4].

Atlantic salmon

Most Southern Gulf of St. Lawrence estuaries can be considered migration routes to salmon spawning grounds located in fresh water. This species is found in the larger rivers and is likely to be present in all accessible tidal rivers; thus no particular area is mapped.

Atlantic tomcod

Most Southern Gulf of St. Lawrence estuaries can generally be considered migration routes to the tomcod spawning grounds located in fresh waters. In addition, fish larvae use the estuaries as feeding grounds until they return to the sea. The data available is incomplete but the species is nevertheless likely to be present in all accessible tidal rivers, thus no particular area is mapped.

Blueback herring

This species is often regrouped with alewife and called gaspereau. The Southern Gulf of St. Lawrence estuaries are generally all migration routes to the blueback herring spawning grounds located in fresh or brackish waters. In addition, fish larvae use the estuaries as feeding grounds until they return to the sea. The data available is incomplete but the species is nevertheless likely to be present in all the accessible rivers, thus no particular area is mapped.

Blue mussel

The species is present everywhere along the coast. Nine areas with high natural concentrations are known in P.E.I. They are presented[A5] in figure 3.4.10.

Gaspereau

The name gaspereau is often used indiscriminately for alewife and blueback herring. Most Southern Gulf of St. Lawrence estuaries can generally be considered migration routes to the gaspereau spawning grounds located in fresh water in lakes and streams. The data available is incomplete but the

species is nevertheless likely to be present in all accessible tidal rivers, thus no particular area is mapped.

Grey seal

The species is abundant and is likely to be present in all coastal areas and estuaries. Three seasonal resting concentrations are known in the Southern Gulf: west of P.E.I.[A6], around Governors Island and around Amet Island[A7] (figures 3.5.4, 3.5.5).

Harbour seal

Little data is available for this species. This species is likely to be present in other areas than the four major ones identified as seasonal resting grounds in the Southern Gulf[A7] (figure 3.5.5).

Rainbow smelt

Most Southern Gulf of St. Lawrence estuaries can generally be considered migration routes to the spawning grounds located in brackish waters. In addition, fish larvae use the estuaries as nursery areas until they move to the sea. The data available is incomplete but the species is nevertheless likely to be present in all accessible tidal rivers, thus no particular area is mapped.

Rock crab

Two high concentration areas are identified from logbook analysis, between Hillsborough Bay, Murray Head, Pictou Island and Amet Sound (figure 3.3.3); and around the current gyre at the end of the Northumberland Strait, and west of P.E.I. (figure 3.3.4)[A8].

Soft shell clam

Four main concentration areas are known in Cascumpec Bay, Malpeque Bay, Bedeque Bay, and in several bays along the East Coast of P.E.I. (figure 3.4.9)[A3,A9-A11]. The species is nevertheless present in all estuaries along the coast. The resource is generally found at depths of less than 0.6 fathoms (1 m)[A8].

Striped bass

The Miramichi River has the largest remaining population of striped bass and is the only confirmed spawning site for that species. Data available for other rivers

have only confirmed that they are used by striped bass as feeding (estuarine portion) and overwintering habitats (mainly in the fresh water portion). Nevertheless, it can be assumed that most estuaries are accessed by that species, thus it is likely to be present in all accessible tidal rivers. No particular area is mapped for this report. Phillip, Pugwash and Wallace rivers have been confirmed as striped bass wintering habitat[A13].

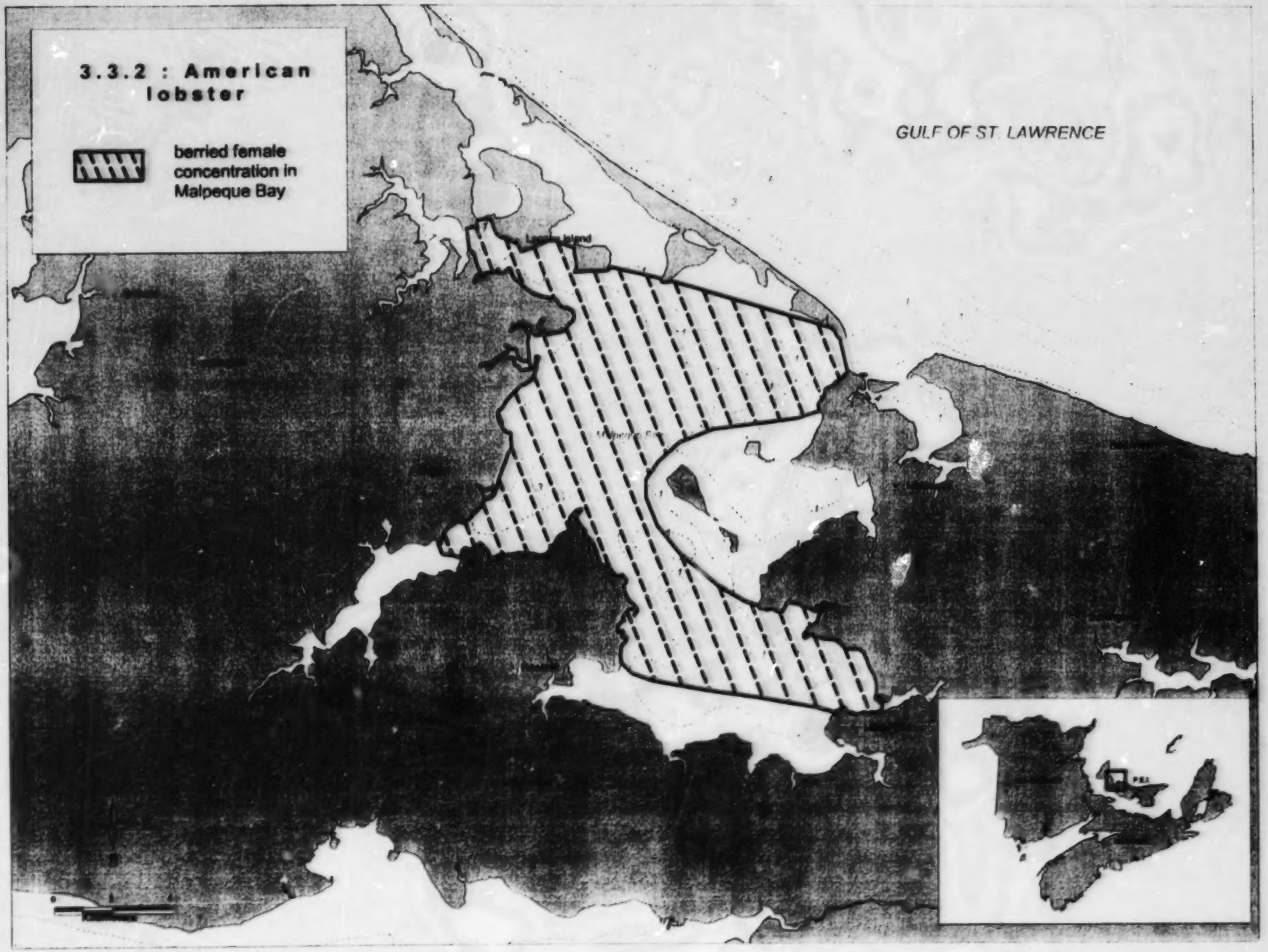
Surfclam

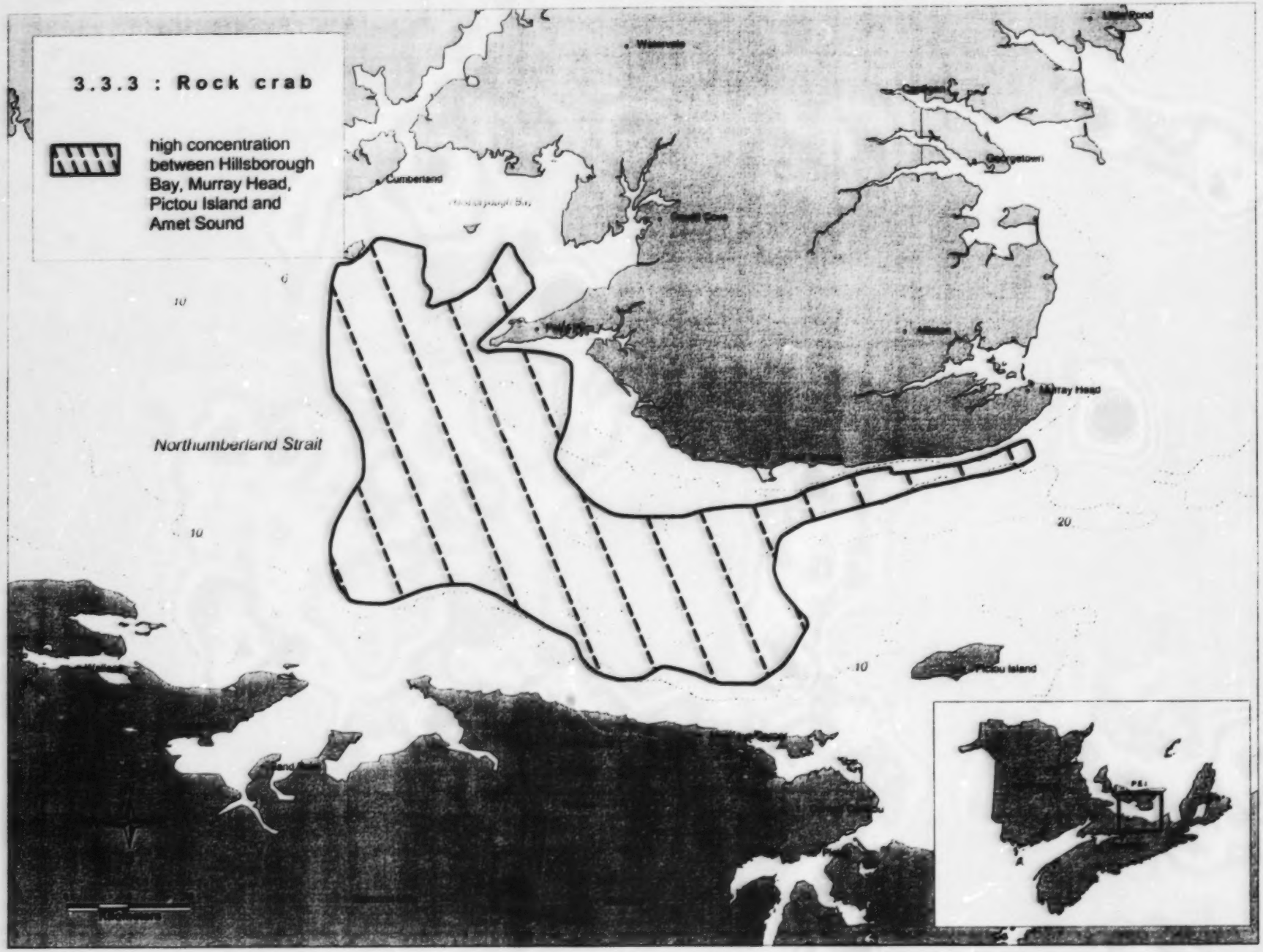
Four main concentration of surfclam (or "bar clam") areas are known, but the species is ubiquitous in high energy sandy surf areas along the coast. Two of these concentrations are manually harvested near Governors Island and Mount Carmel (P.E.I.), while two others are mechanically harvested in Wood Island and north of Cascumpec Bay to New London (P.E.I.) (figure 3.4.8)[A1-A3]. The boundaries of these areas are extrapolated from the usual depth of harvesting, i.e. shallow waters for manual harvest and between 3 and 15 m for mechanical harvest.[A1,A2] However, the distribution of this resource may extend to a wider area at depth ranging from the intertidal zone to 25 m deep[A14].

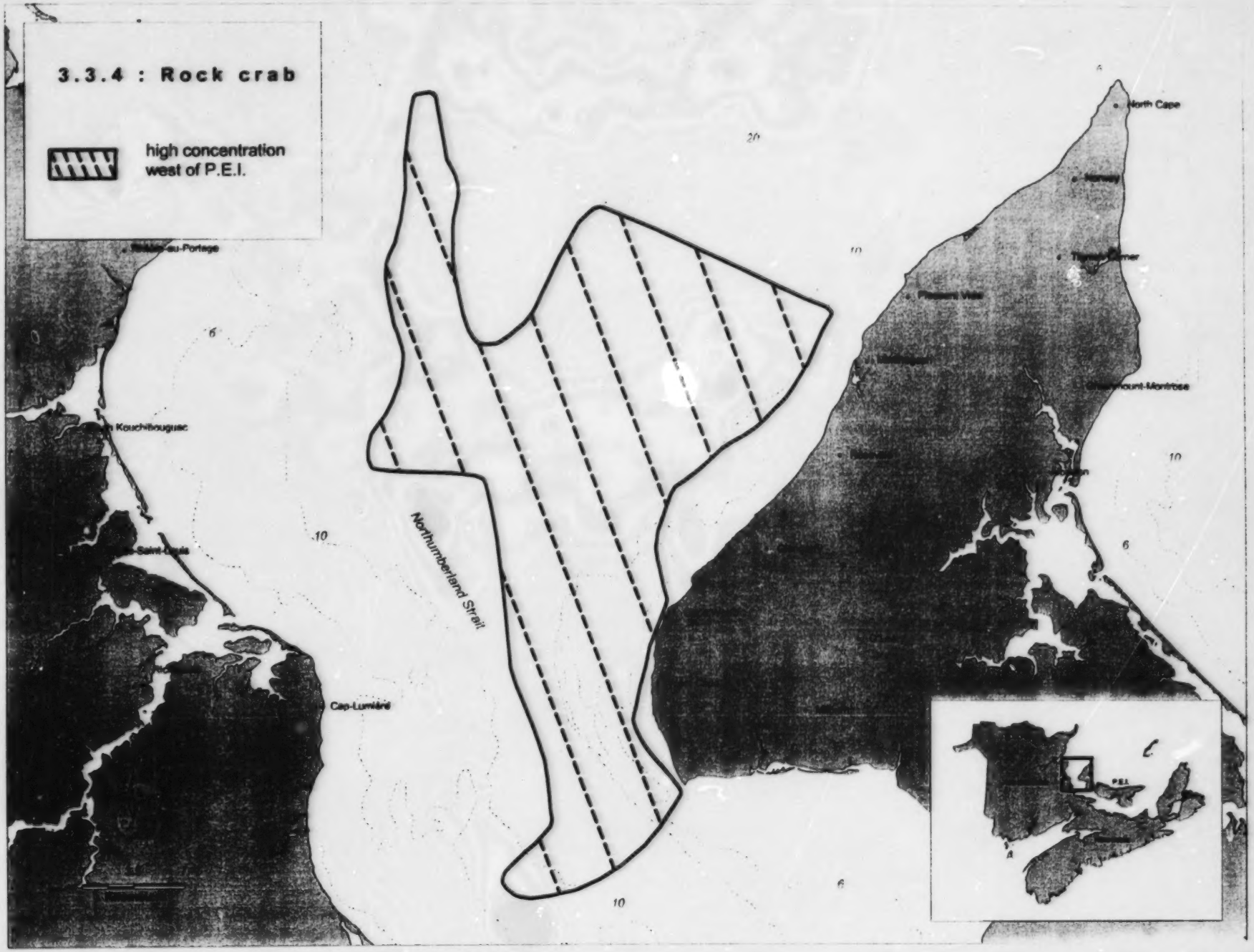
References

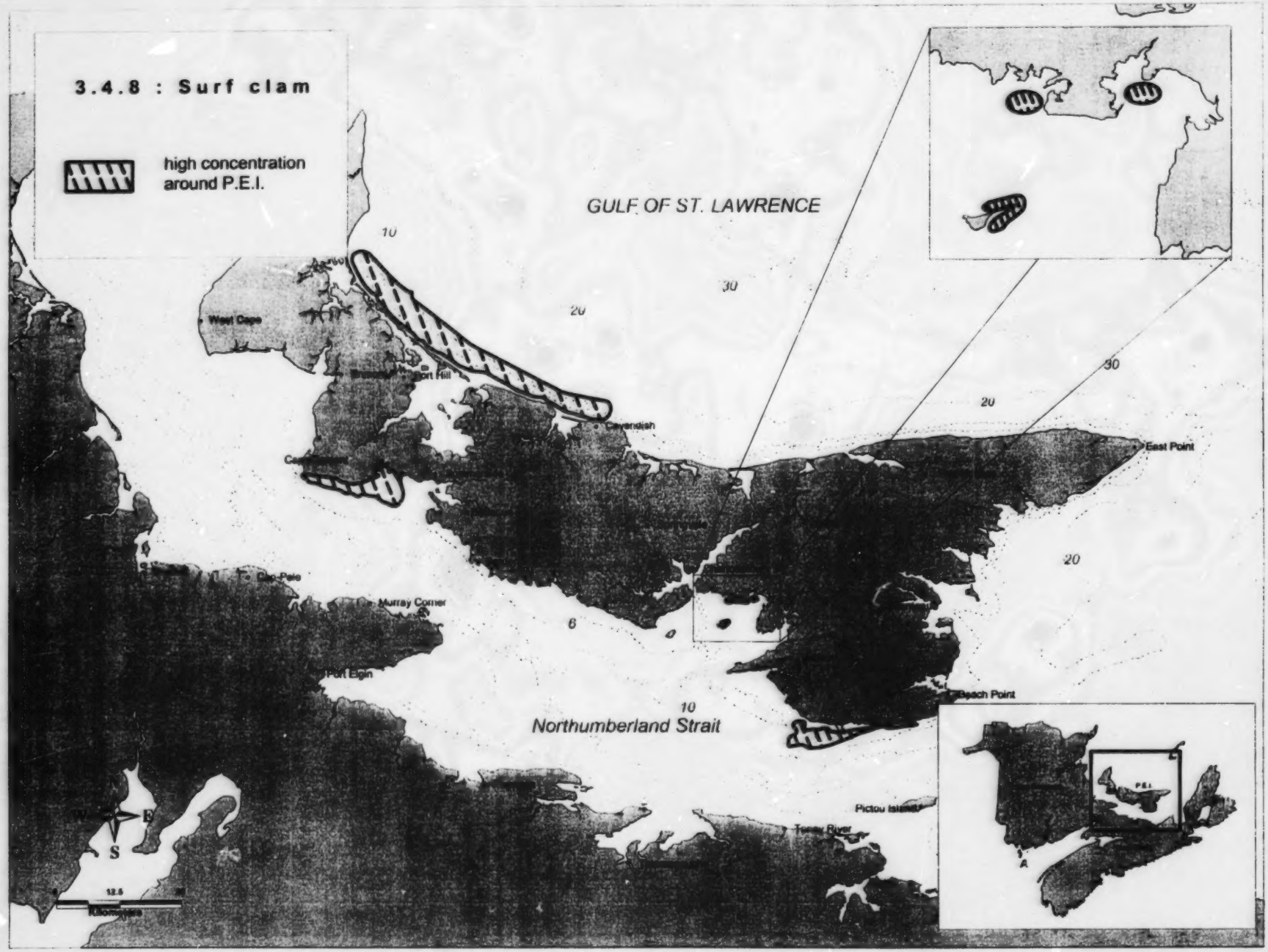
A1 : J. Jenkins, p.c. 2001
A2 : J. Sheidow, p.c. 2001
A3 : MacNeil, J.L. & Assoc., 1998
A4 : DFO (Herring), 2001c
A5 : M. Smith, p.c. 2001
A6 : Therrien et al., 2000
A7 : J-F Gosselin, p.c. 2001
A8 : F. Savoie, p.c. 2001
A9 : T. Landry, p.c. 2001
A10 : D. Cairns, p.c. 2001
A11 : B. MacInnis, p.c. 2001
A12 : M. Robinson, p.c. 2001
A13 : D. Austin, p.c. 2001
A14 : DFO (surf clam), 1996a

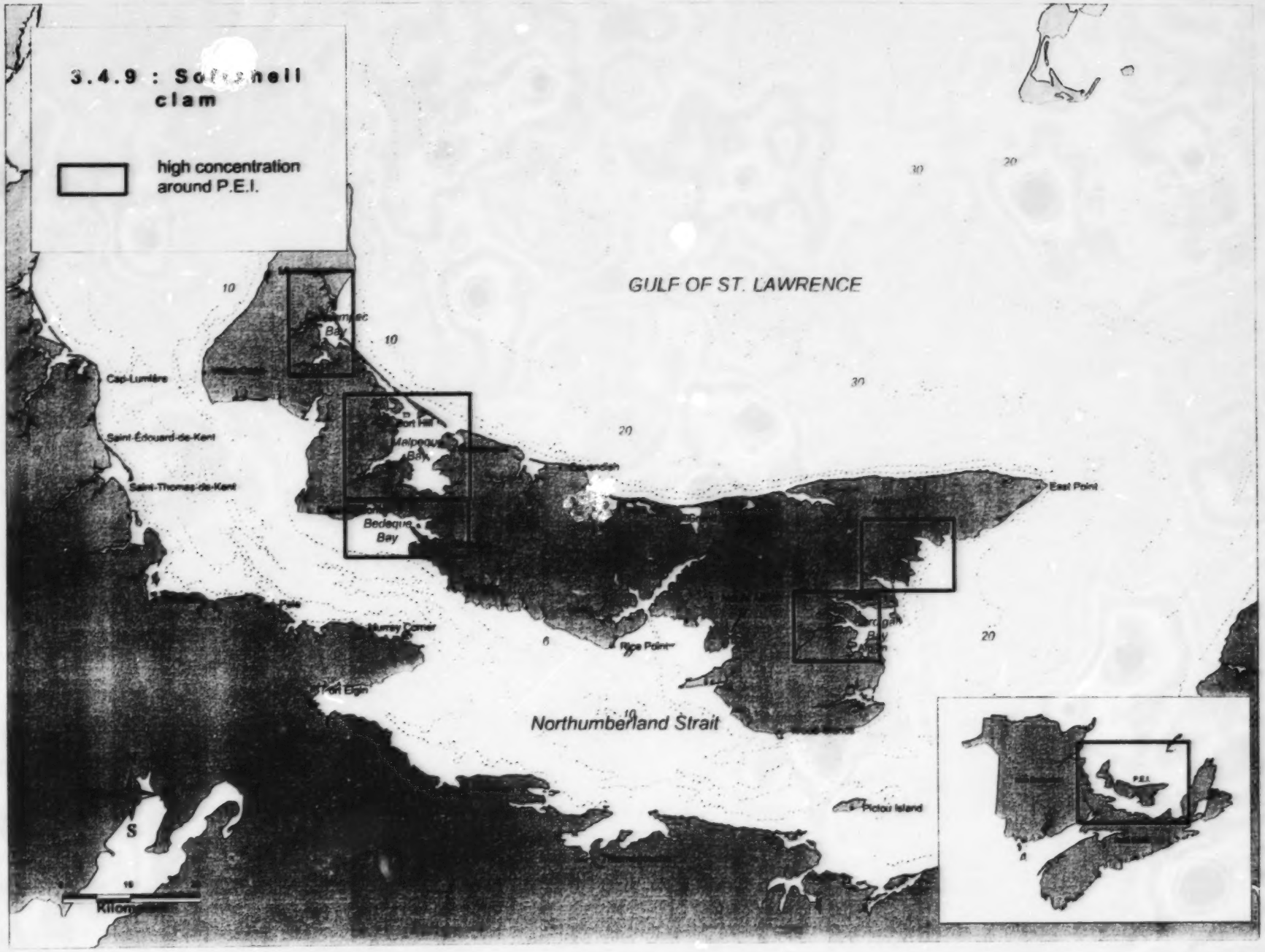
3.2.15 : Atlantic herring
spring spawning ground from Baie Verte to Amet Sound
GULF OF ST. LAWRENCE
Northumberland Strait
Murray Corner
Rice Point
Pictou Island
PEI

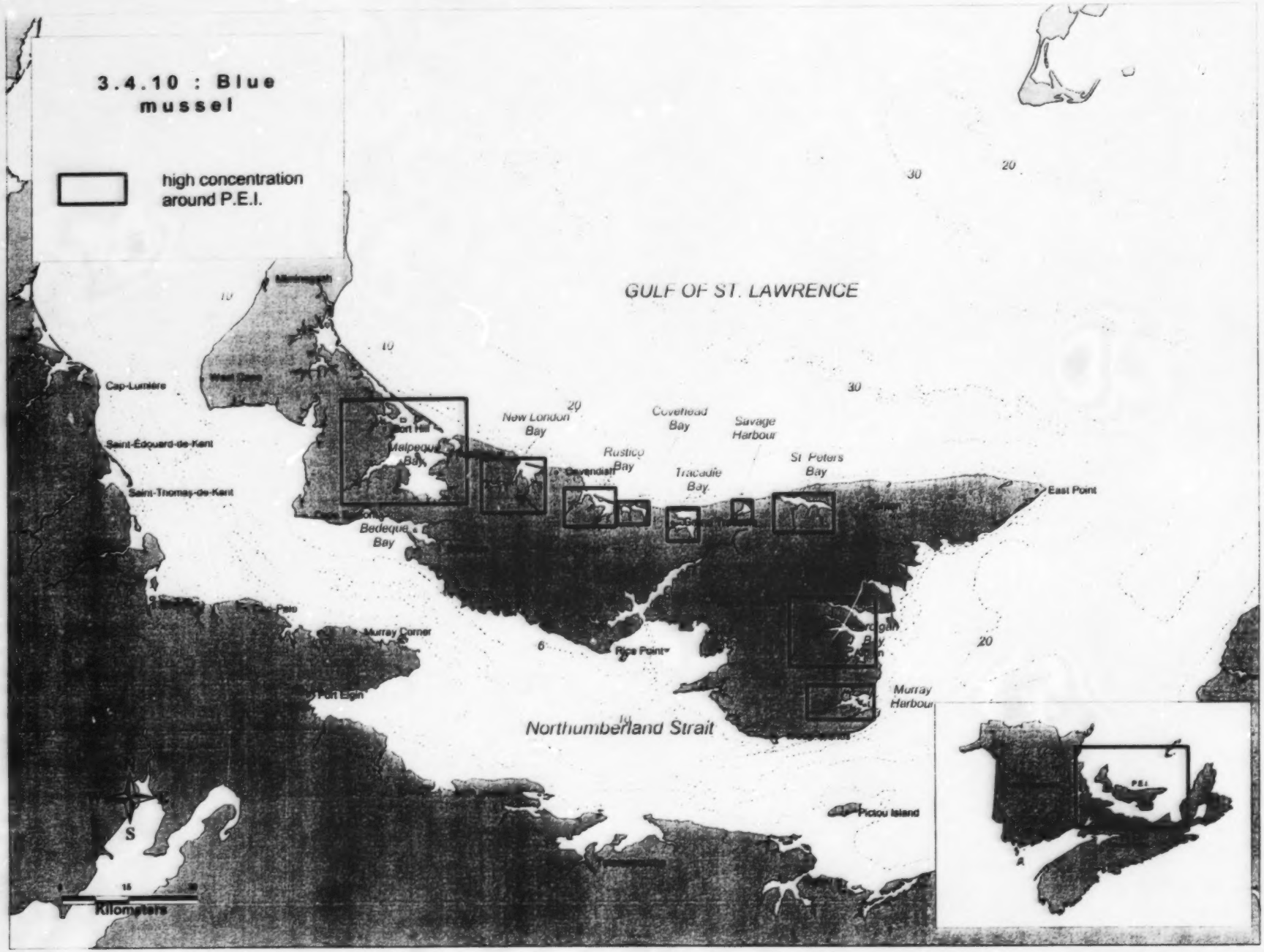

3.3.2 : American lobster
berried female concentration in Malpeque Bay
GULF OF ST. LAWRENCE
PEI

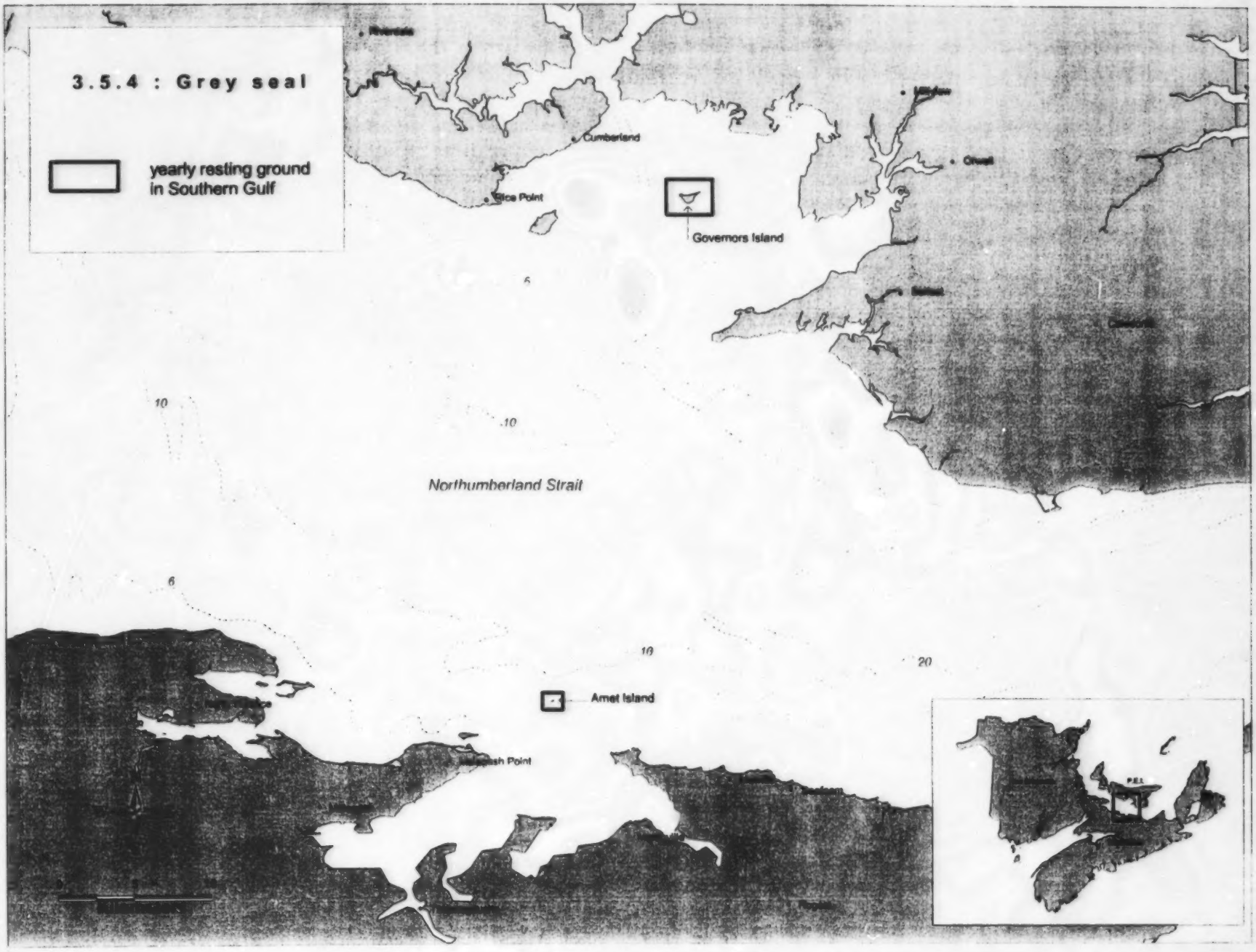

3.3.3 : Rock crab
high concentration between Hillsborough Bay, Murray Head, Pictou Island and Amet Sound
Northumberland Strait
Wallace
Cumberland
Georgetown
Murray Head
Pictou Island
P.E.I.

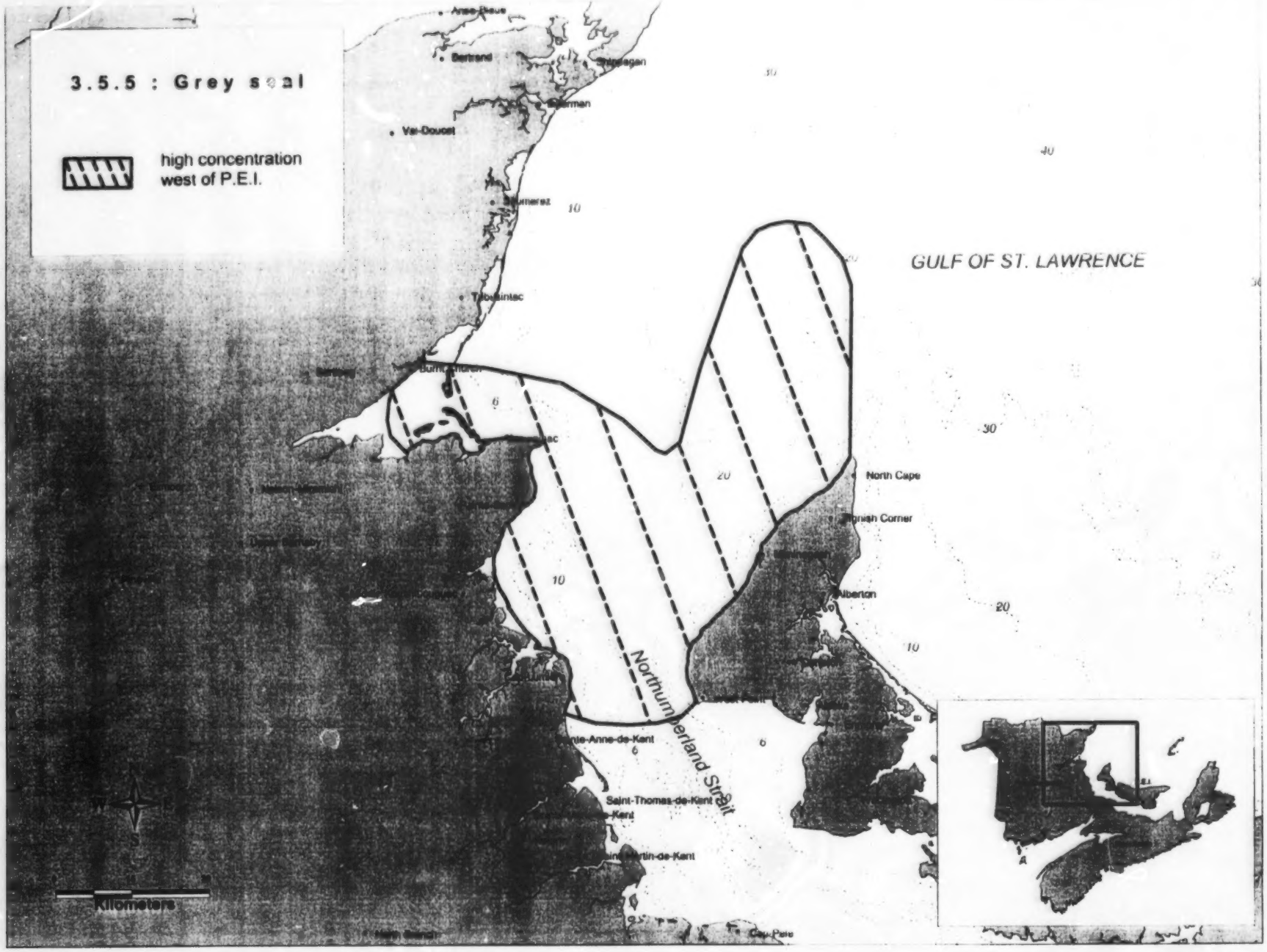

3.3.4 : Rock crab
high concentration west of P.E.I.
Northumberland Strait
North Cape
Cap-Lumière
PEI

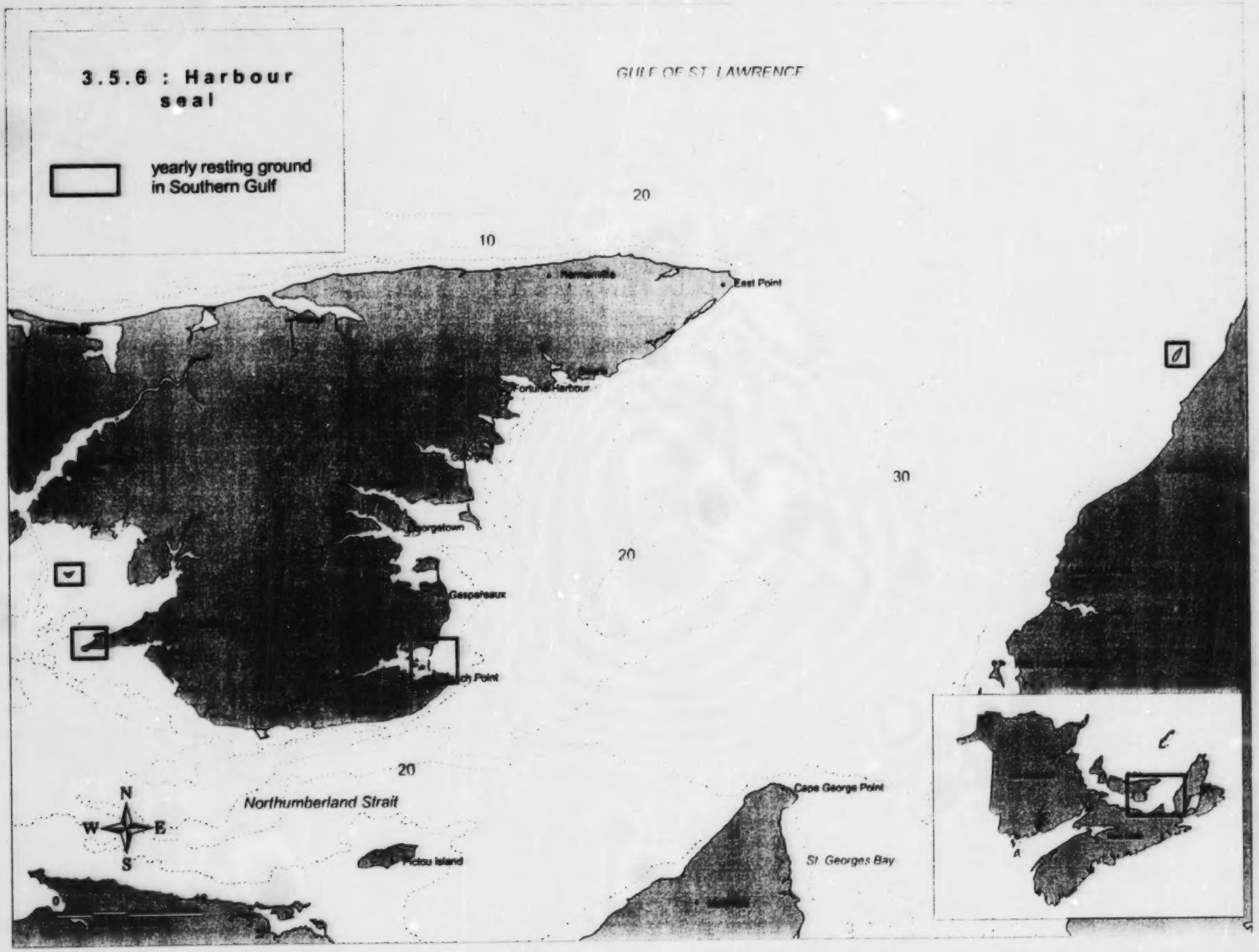

3.4.8 : Surf clam
high concentration around P.E.I.
GULF OF ST. LAWRENCE
Northumberland Strait
West Cape
Cavendish
East Point
Murray Corner
Port Egin
Beach Point
Pictou Island
Tignish
P.E.I.
10
20
30
6


3.4.9 : Soft-shell clam
high concentration around P.E.I.
GULF OF ST. LAWRENCE
Cap-Lumière
Saint-Édouard-de-Kent
Saint-Thomas-de-Kent
Bedeque Bay
East Point
Murray Corner
Rice Point
Northumberland Strait
Pictou Island
P.E.I.
10
20
30
6


3.4.10 : Blue mussel
high concentration around P.E.I.
GULF OF ST. LAWRENCE
Northumberland Strait
Cap-Lumière
Saint-Édouard-de-Kent
Saint-Thomas-de-Kent
Melpeque Bay
New London Bay
Rustico Bay
Cavendish
Covehead Bay
Savage Harbour
Tracadie Bay
St Peters Bay
East Point
Bedeque Bay
Pato
Murray Corner
Rice Point
Port Egin
Murray Harbour
Pictou Island
PEI
Kilometers
30
20
10
6


3.5.4 : Grey seal
yearly resting ground in Southern Gulf
Cumberland
Governors Island
Northumberland Strait
Amet Island
10
20
6


3.5.5 : Grey seal
high concentration
west of P.E.I.
GULF OF ST. LAWRENCE
Anse-Bleue
Bertrand
Shippagan
Caraquet
Val-Doucet
Tabusintac
North Cape
Miminegash
Alberton
Northumberland Strait
Saint-Thomas-de-Kent
Kilometers
Cap-Pele


3.5.6 : Harbour seal
yearly resting ground in Southern Gulf
GULF OF ST. LAWRENCE
20
10
East Point
30
20
Gaspereaux
20
Northumberland Strait
N
W
E
S
Pictou Island
Cape George Point
St. Georges Bay

APPENDIX B

Latin names of species mentioned in the text

Appendix B. Latin names of species mentioned in the text.

Common name	Latin name
American eel	*Anguilla rostrata*
American lobster	*Homarus americanus*
American oyster	*Crassostrea virginica*
American plaice	*Hippoglossoides platessoides*
American sand lance	*Ammodytes americanus*
American shad	*Alosa sapidissima*
Atlantic cod	*Gadus morhua*
Atlantic halibut	*Hippoglossus hippoglossus*
Atlantic herring	*Clupea harengus*
Atlantic mackerel	*Scomber scombrus*
Atlantic salmon	*Salmo salar*
Atlantic silverside	*Menidia menidia*
Atlantic sturgeon	*Acipenser oxyrynchus*
Atlantic tomcod	*Microgadus tomcod*
Bald eagle	*Haliaeetus leucocephalus*
Banded killifish	*Fundulus diaphanus*
Barrow's goldeneye	*Bucephala islandica*
Black-back gull	*Larus sp*
Black duck	*Anas rubripes*
Black guillemot	*Cepphus grylle*
Black-legged Kittiwake	*Rissa tridactyla*
Blue mussel	*Mytilus edulis*
Blue shark	*Prionace glauca*
Blueback herring	*Alosa aestivalis*
Bluefin tuna	*Thunnus thynnus*
Brant geese	*Branta bernicla*
Brown trout	*Salmo trutta*
Capelin	*Mallotus villosus*
Common sucker	*Catostomus commersoni*
Common tern	*Sterna hirundo*
Cunner	*Tautogolabrus adspersus*
Double-crested cormorant	*Phalacrocorax auritus*
Eelgrass	*Zostera sp.*
Fin whale	*Balaenoptera physalus*
Gaspereau / Alewife	*Alosa pseudoharengus*
Golden shiner	*Notemigonus crysoleucas*
Green sea urchin	*Strongylocentrotus drōebachiensis*
Grey seal	*Halichoerus grypus*

Harbour porpoise	*Phocoena phocoena*
Harbour seal	*Phoca vitulina*
Harp seal	*Phoca groenlandica*
Heron	*Nycticorax sp*
Herring gull	*Larus sp*
Hooded seal	*Cystophora cristata*
Humpack whale	*Megaptera novaeangliae*
Iceland gull	*Larus sp*
Irish moss	*Chondrus crispus*
Littorina	*Littorina sp.*
Mako shark	*Isurus oxyrinchus*
Merganser	*Mergus sp.*
Minke whale	*Balaenoptera acutorostrata*
Minnow	Family Cyprinidae
Mummichog	*Fundulus heteroclitus*
Northern Gannet	*Morus bassanus*
Northern pipefish	*Syngnathus fuscus*
Northern shrimp	*Pandalus borealis*
Orca	*Orcinus orca*
Osprey	*Pandion haliaetus*
Periwinkle	*Littorina littorea*
Pilot whale	*Globicephala melas*
Piping plover	*Charadrius melodus*
Porbeagle shark	*Lamna nasus*
Quahaug	*Mercenaria mercenaria*
Rainbow smelt	*Osmerus mordax*
Rock crab	*Cancer irroratus*
Scirpus	*Scirpus*
Sculpin	*Myoxocephalus sp.*
Sea lamprey	*Petromyzon marinus*
Sea lettuce	*Ulva sp.*
Sea scallop	*Placopecten magellanicus*
Sea trout/ brook trout	*Salvelinus fontinalis*
Smooth flounder	*Pleuronectes putnami*
Smooth skate	*Raja senta*
Snow crab	*Chionoecetes opilio*
Softshell clam	*Mya arenaria*
Spartina	*Spartina*
Squid	*Illex illecebrosus / Loligo pealei*
Stickleback	Family Gasterosteidae
Striped bass	*Morone saxatilis*

Stone crab	*Panopeus sp.*
Surf clam	*Spisula solidissima*
Toad crab	*Hyas araneus*
White hake	*Urophysis tenuis*
White perch	*Morone americana*
White-sided dolphin	*Lagenorhynchus acutus*
Winter flounder	*Pleuronectes americanus*
Wolffish	*Anarhichas lupus*

APPENDIX C

Names of resource persons contacted or interviewed

Appendix C. Names of resource persons contacted or interviewed

Researchers, biologist and technicians contacted or interviewed

Ross Alexander--Fisheries and Oceans Canada, Moncton, N.B.
Diane Archambault--Fisheries and Oceans Canada, Mont-Joli, Qc
Jean-Louis Beaulieu--Fisheries and Oceans Canada, Mont-Joli, Qc
David Cairns--Fisheries and Oceans Canada, Charlottetown, P.E.I.
Gérald Chaput--Fisheries and Oceans Canada, Moncton, N.B.
Simon Courtenay--Fisheries and Oceans Canada, Moncton, N.B.
Rosemary Curly--Fisheries, Aquaculture and Environment, Charlottetown, P.E.I.
Ted Curry--Fisheries and Oceans Canada, Moncton, N.B.
Ghislain Chouinard--Fisheries and Oceans Canada, Moncton, N.B.
Robert Christie--Pictou Harbour Environmental Protection Project, New Glasgow, N.S.
Leslie-Ann Davidson--Fisheries and Oceans Canada, Moncton, N.B.
Randy Dibblee--Fisheries, Aquaculture and Environment, Charlottetown, P.E.I.
Dave Gillis--Fisheries, Aquaculture and Environment, Charlottetown, P.E.I.
Jean-François Gosselin--Fisheries and Oceans Canada, Mont-Joli, Qc
François Grégoire--Fisheries and Oceans Canada, Mont-Joli, Qc
Mark Hanson--Fisheries and Oceans Canada, Moncton, N.B.
James Jenkins--Fisheries and Oceans Canada, Charlottetown, P.E.I.
Thomas Landry--Fisheries and Oceans Canada, Moncton, N.B.
Wade Landsburg--Fisheries and Oceans Canada, Moncton, N.B.
Marc Lanteigne--Fisheries and Oceans Canada, Moncton, N.B.
Claude LeBlanc--Fisheries and Oceans Canada, Moncton, N.B.
Andrea Locke--Fisheries and Oceans Canada, Moncton, N.B.
Lynda Maclean--Fisheries and Oceans Canada, Charlottetown, P.E.I.
Bobby MacInnis--Fisheries and Oceans Canada, Charlottetown, P.E.I.
Charlie MacInnis--Fisheries and Oceans Canada, Antigonish, N.S.
Lee MacNeil—Lee MacNeil and Associates, Amherst, P.E.I.
Dave McEwen--Fisheries, Aquaculture and Environment, Charlottetown, P.E.I.
Rodrigue Morin--Fisheries and Oceans Canada, Moncton, N.B.
Mikio Moriyasu--Fisheries and Oceans Canada, Moncton, N.B.
Lea Murphy--Fisheries and Oceans Canada, Charlottetown, P.E.I.
Julie Porter--Fisheries and Oceans Canada, St. Andrews, N.S.
Frank Ring--Fisheries and Oceans Canada, Moncton, N.B.
Fernand Savole--Fisheries and Oceans Canada, Moncton, N.B.
Bruce Smith--Fisheries, Aquaculture and Environment, Charlottetown, P.E.I.
Matt Smith--Fisheries, Aquaculture and Environment, Charlottetown, P.E.I.
Heath Stone--Fisheries and Oceans Canada, St. Andrews, N.S.

Fisheries officers contacted or interviewed

Gordon Aucoin--Cheticamp, N.S.
Dave Austin--Wallace, N.S.
Paul Gallant--Souris, P.E.I.
Arthur LeBlanc--Cheticamp, N.S.
John A. MacIntyre--Port Hood, N.S.
Camille Poirier--Pictou, N.S.
Bryan Scallion--Wallace, N.S.
Jeff Sheidow--Summerside, P.E.I.

APPENDIX D

List of Participants at the
Regionally Significant Habitat Workshop on June 7th, 2001

Appendix D. List of Participants at the Regionally Significant Habitat Workshop on June 7th, 2001

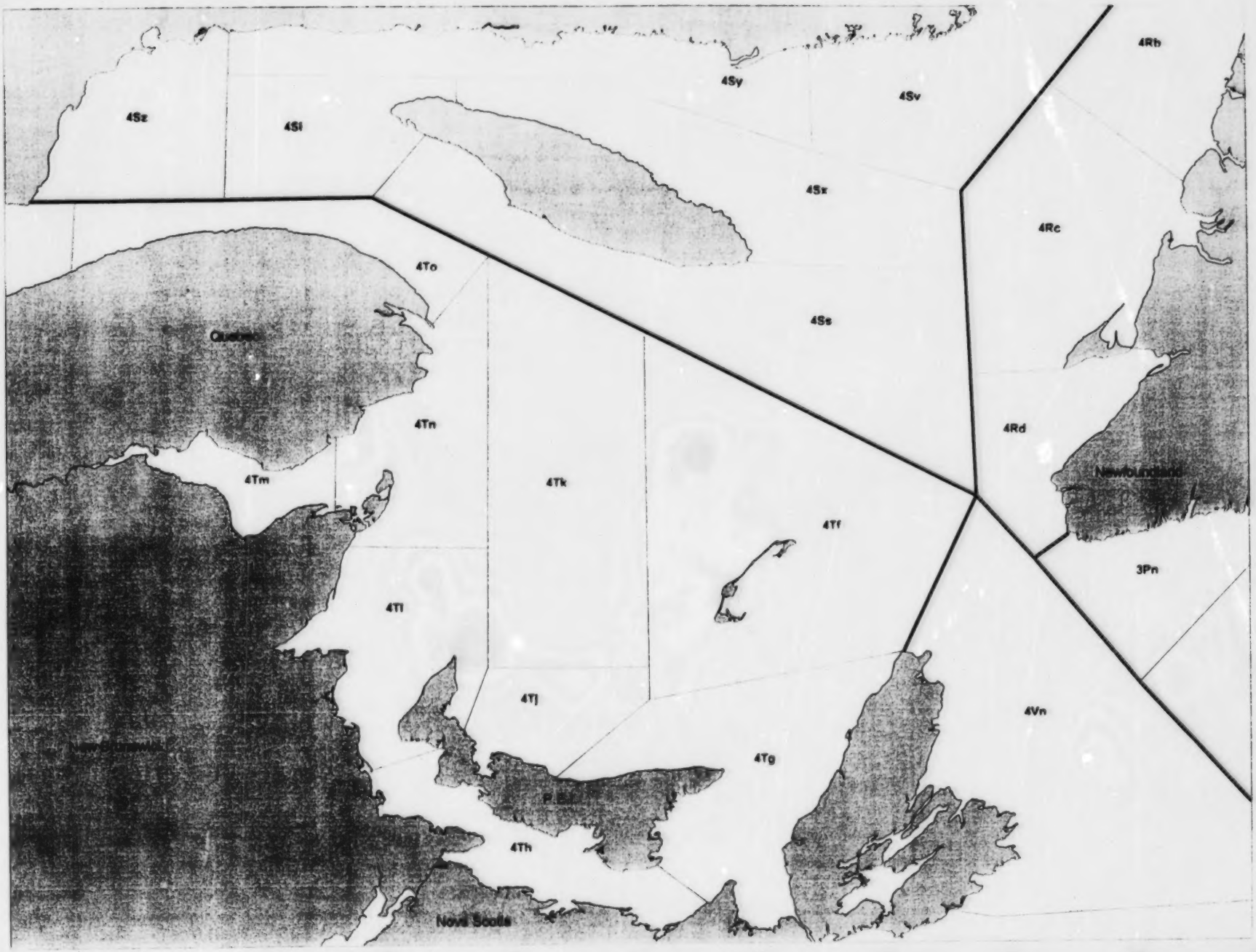
NAME	ORGANIZATION	MAILING ADDRESS
Brad Firth	DFO / Oceans and Coastal Management division, Oceans Branch	Gulf Fisheries Centre, P.O. Box 5030, Moncton, N.B., E1C 9B6
Camille Poirier	DFO / Conservation and Protection Branch	Gulf Fisheries Centre, P.O. Box 460, Pictou, N.S.
Carole Godin	DFO / Oceans and Coastal Management division, Oceans Branch	Gulf Fisheries Centre, P.O. Box 5030, Moncton, N.B., E1C 9B6
Claude LeBlanc	DFO, Marine Fish Section, Science Branch	Gulf Fisheries Centre, P.O. Box 5030, Moncton, N.B., E1C 9B6
Dave Duggan	DFO / Oceans and Coastal Management division, Oceans Branch	Bedford Institute of Oceanography, 1 Challenger Drive, Dartmouth, N.S., B2Y 4A2
Dave M"Ewen	P.E.I. Dept. Of Fisheries, Aquaculture and Environment	11 Kent St. Charlottetown, P.E.I. C1H 7N8
David Cairns	DFO / Diadromous Fish Section, Science Branch	Charlottetown
Denise M'Cullough	DFO / Oceans and Coastal Management division, Oceans Branch	Bedford Institute of Oceanography, 1 Challenger Drive, Dartmouth, N.S., B2Y 4A2
Derek Fenton	DFO / Oceans and Coastal Management division, Oceans Branch	Bedford Institute of Oceanography, 1 Challenger Drive, Dartmouth, N.S., B2Y 4A2
Doug Swain	DFO, Diadromous Fish Section, Science Branch	Gulf Fisheries Centre, P.O. Box 5030, Moncton, N.B., E1C 9B6
Fernand Savoie	DFO, Lobster Section, Science Branch	Gulf Fisheries Centre, P.O. Box 5030, Moncton, N.B., E1C 9B6
J. Mark Hanson	DFO, Director's office, Science Branch	Gulf Fisheries Centre, P.O. Box 5030, Moncton, N.B., E1C 9B6
Jean Therrien	Genivar Consulting Group inc.	5355 boul.des Gradins, Quebec (Qc.) G2J 1C8
Kevin Davidson	Environnement Canada, Canadian Wildlife Services	P.O. Box 6227, Sackville, N.B., E4L 1G6
Leaming Murphy	DFO, Fish Habitat Management Division, Oceans Branch	Charlottetown CG Base, P.O. Box 1236, Charlottetown, P.E.I. C1A 7M8
Leslie-Anne Davidson	DFO, Aquaculture Section, Science Branch	Gulf Fisheries Centre, P.O. Box 5030, Moncton, N.B., E1C 9B6.

Maria-Ines Buzeta	DFO / Oceans and Coastal Management Division, Oceans Branch	St. Andrews Biological Station, 531 Brandy Cove Road, St. Andrews-by-the-Sea. N.B. E5B 2L9
Noella Boucher	DFO, Fisheries Management Division,	Gulf Fisheries Centre, P.O. Box 5030, Moncton, N.B., E1C 9B6
Paul Boyd	DFO / Oceans and Coastal Management Division, Oceans Branch	Antigonish Mall, 133 Church St., Antigonish, N.S. B2G 2E3
Ray M^{c}Isaac	St. Francis Xavier University	26 Sylvana Valley Rd. Antigonish, N.S. B2J 2W5
Rhéal Vienneau	DFO, Resource Management Branch	Gulf Fisheries Centre, P.O. Box 5030, Moncton, N.B., E1C 9B6
Rod Morin	DFO, Marine Fish Section, Science Branch	Gulf Fisheries Centre, P.O. Box 5030, Moncton, N.B., E1C 9B6
Simon Courtenay	DFO, Marine Environmental Sciences Division, Oceans Branch	Gulf Fisheries Centre, P.O. Box 5030, Moncton, N.B., E1C 9B6
Sophie Bastien-Daigle	DFO / Oceans and Coastal Management Division, Oceans Branch	Gulf Fisheries Centre, P.O. Box 5030, Moncton, N.B., E1C 9B6
Tara Perley	DFO, Aboriginal Fisheries Program, Resource Management Branch	Gulf Fisheries Centre, P.O. Box 5030, Moncton, N.B., E1C 9B6
Thomas Landry	DFO, Aquaculture Section, Science Branch	Gulf Fisheries Centre, P.O. Box 5030, Moncton, N.B., E1C 9B6
Tom Hurlbut	DFO, Marine Fish Section, Science Branch	Gulf Fisheries Centre, P.O. Box 5030, Moncton, N.B., E1C 9B6

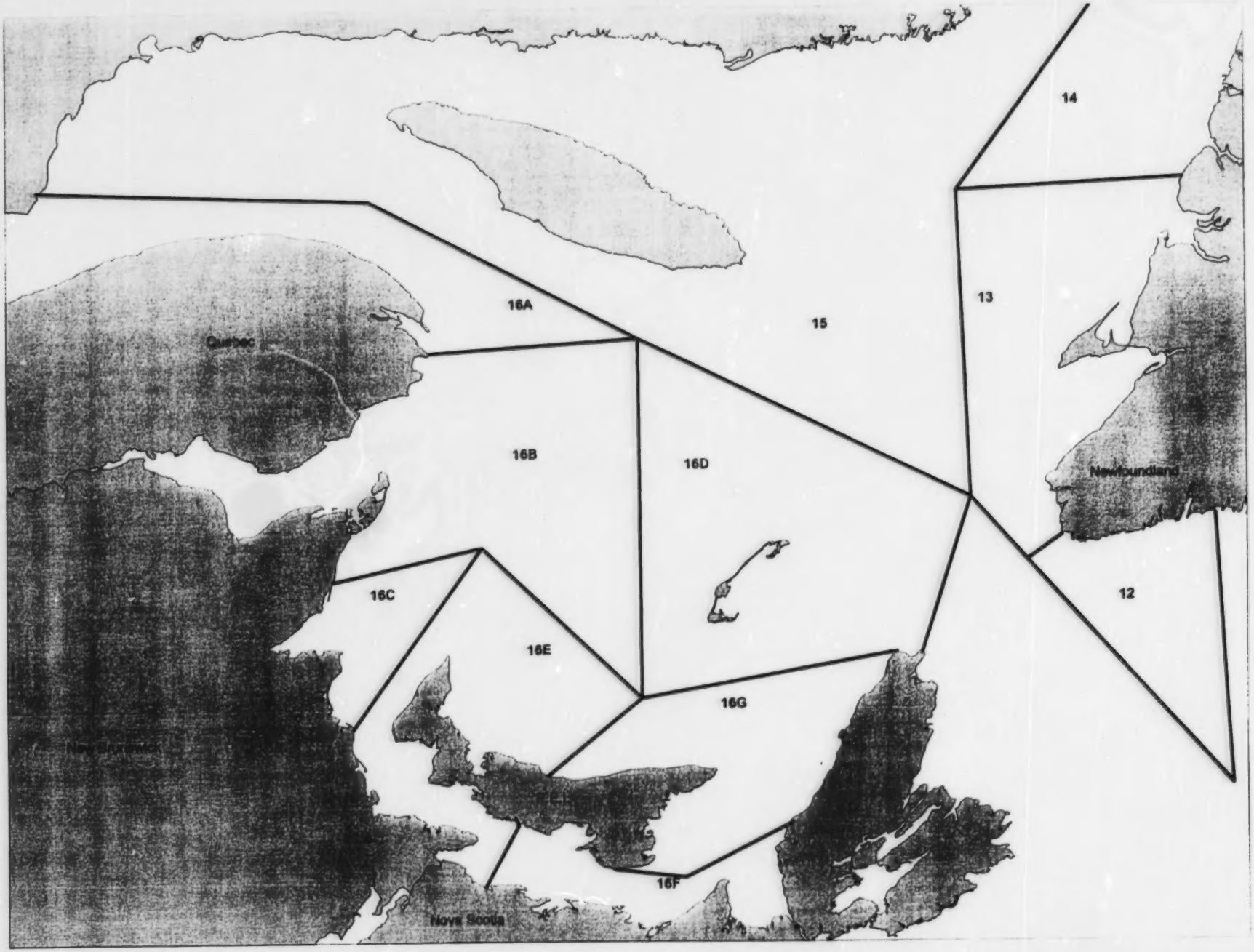
APPENDIX E

Statistical districts

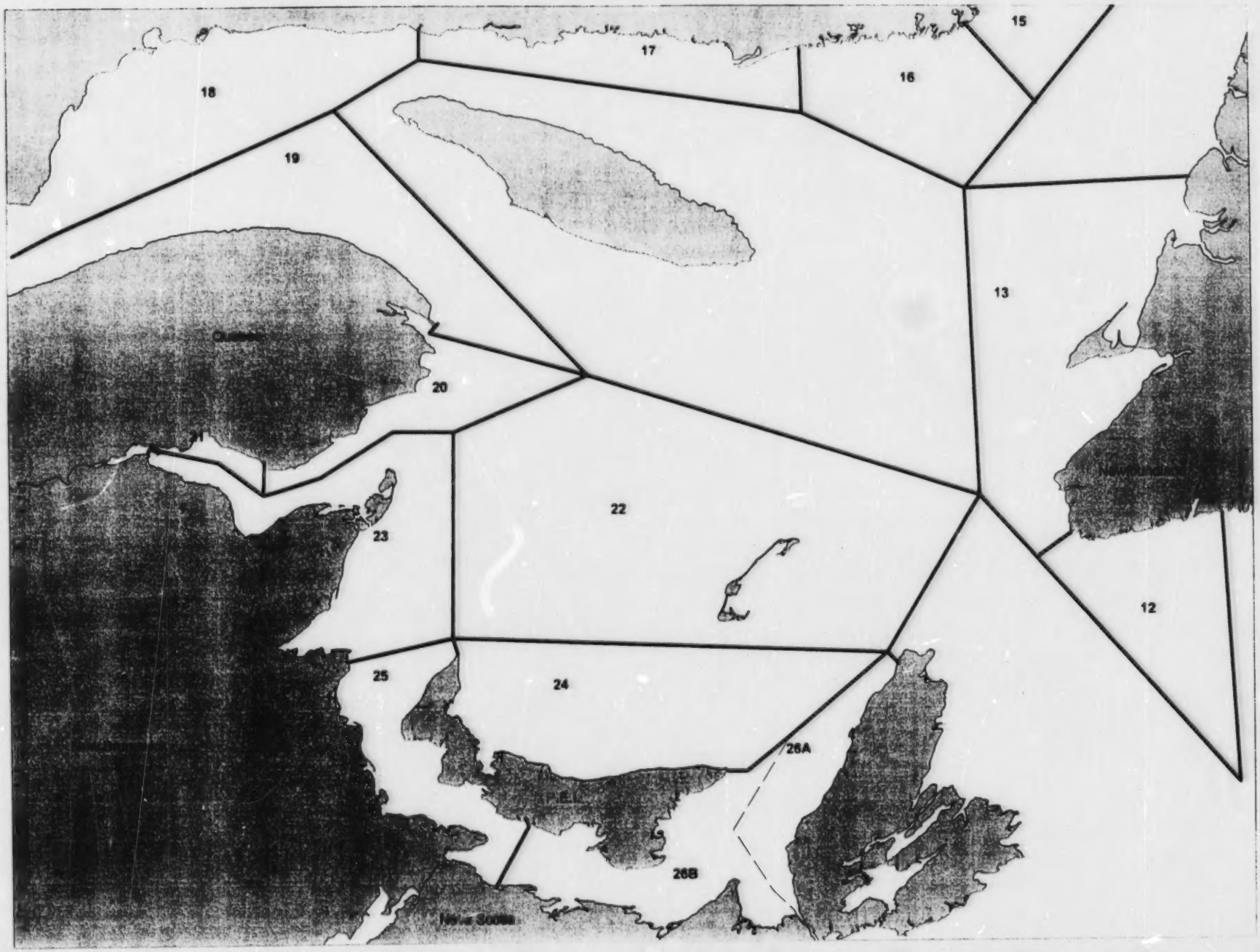
NAFO Convention Area



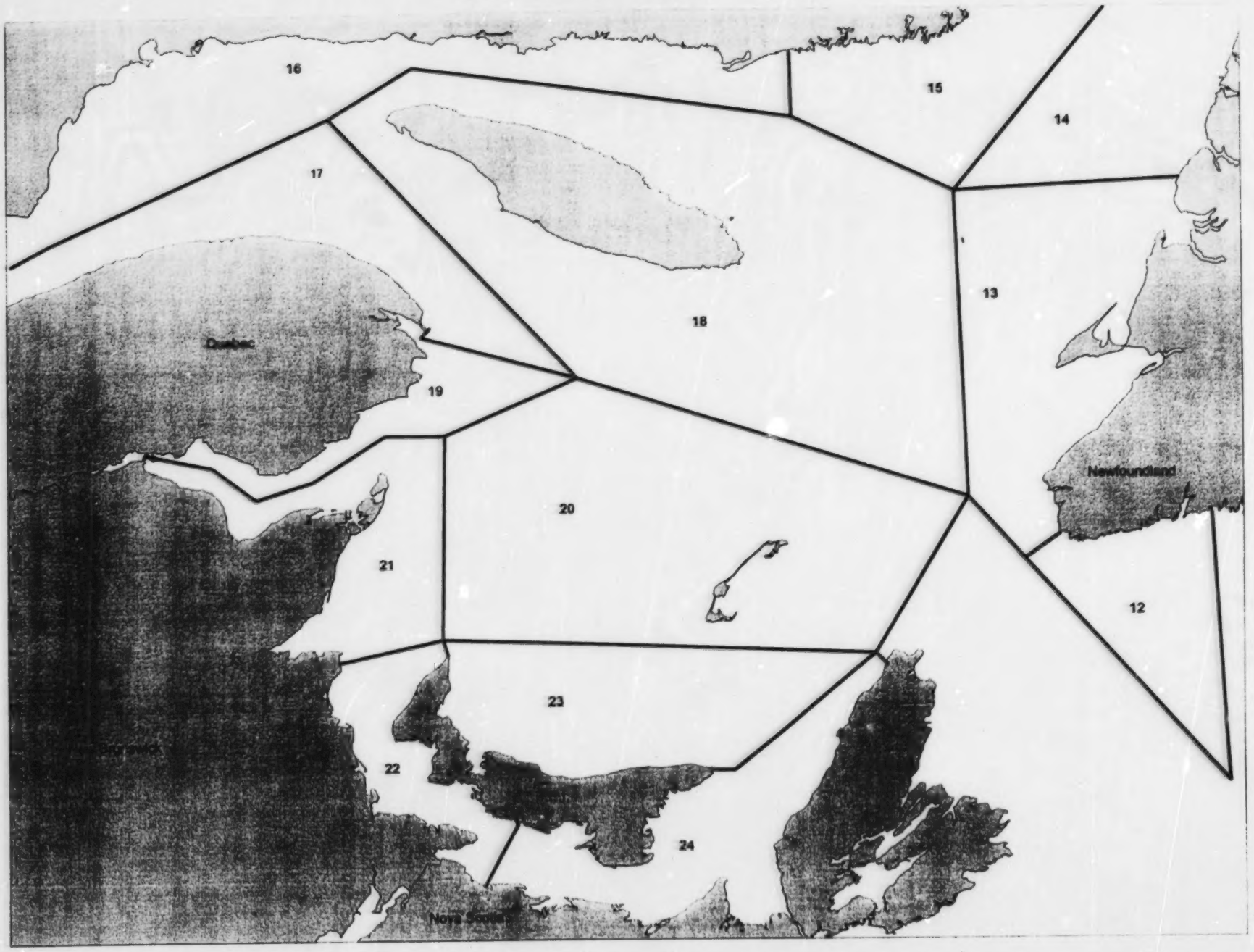
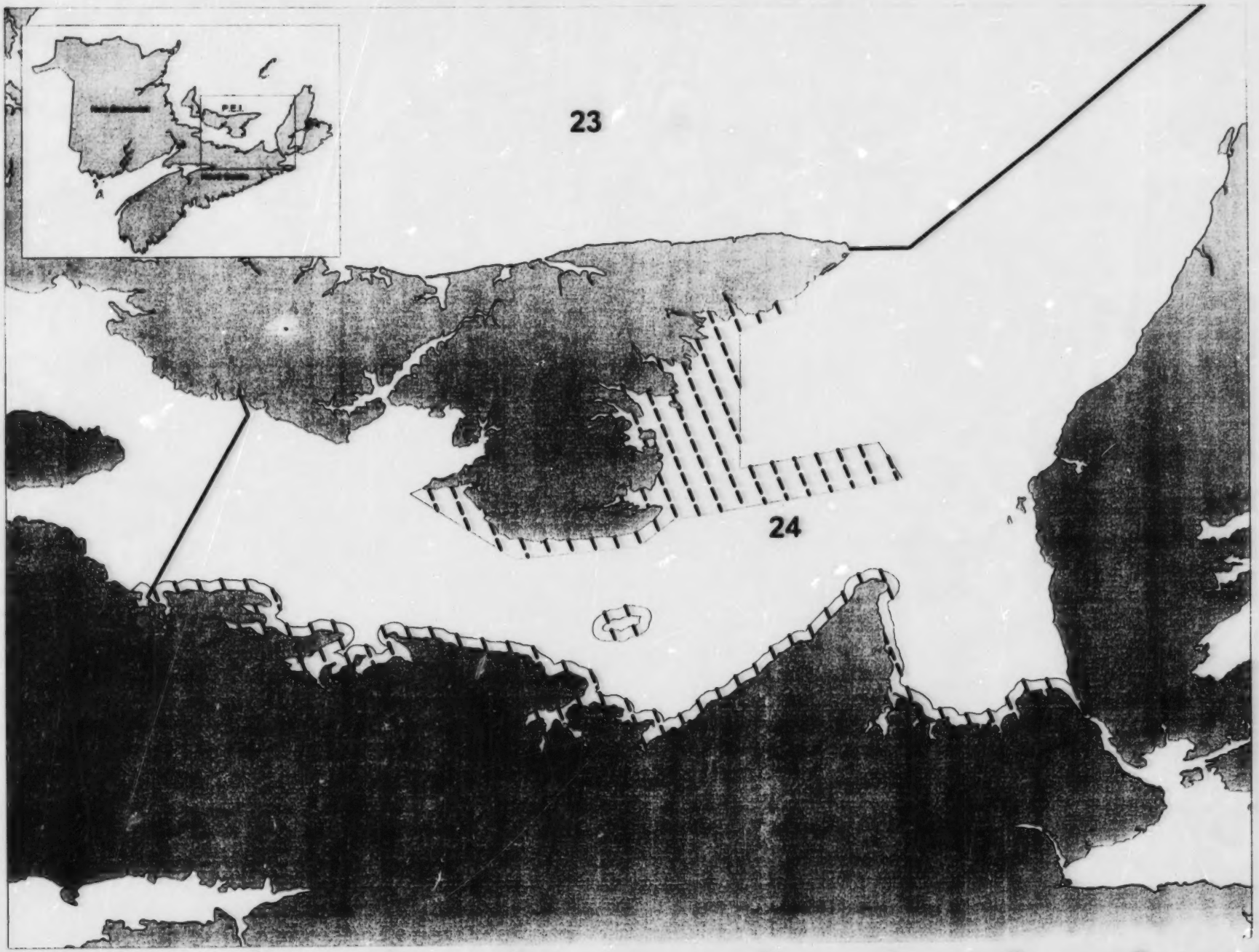
Herring Fishing District



Lobster Fishing District



Scallop Fishing District



Scallop Fishing Area 24 Buffer Zone